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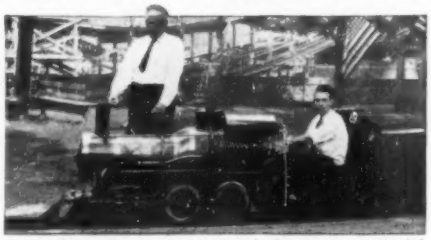

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SKF INDUSTRIES, Inc., 40 East 34th Street, New York City

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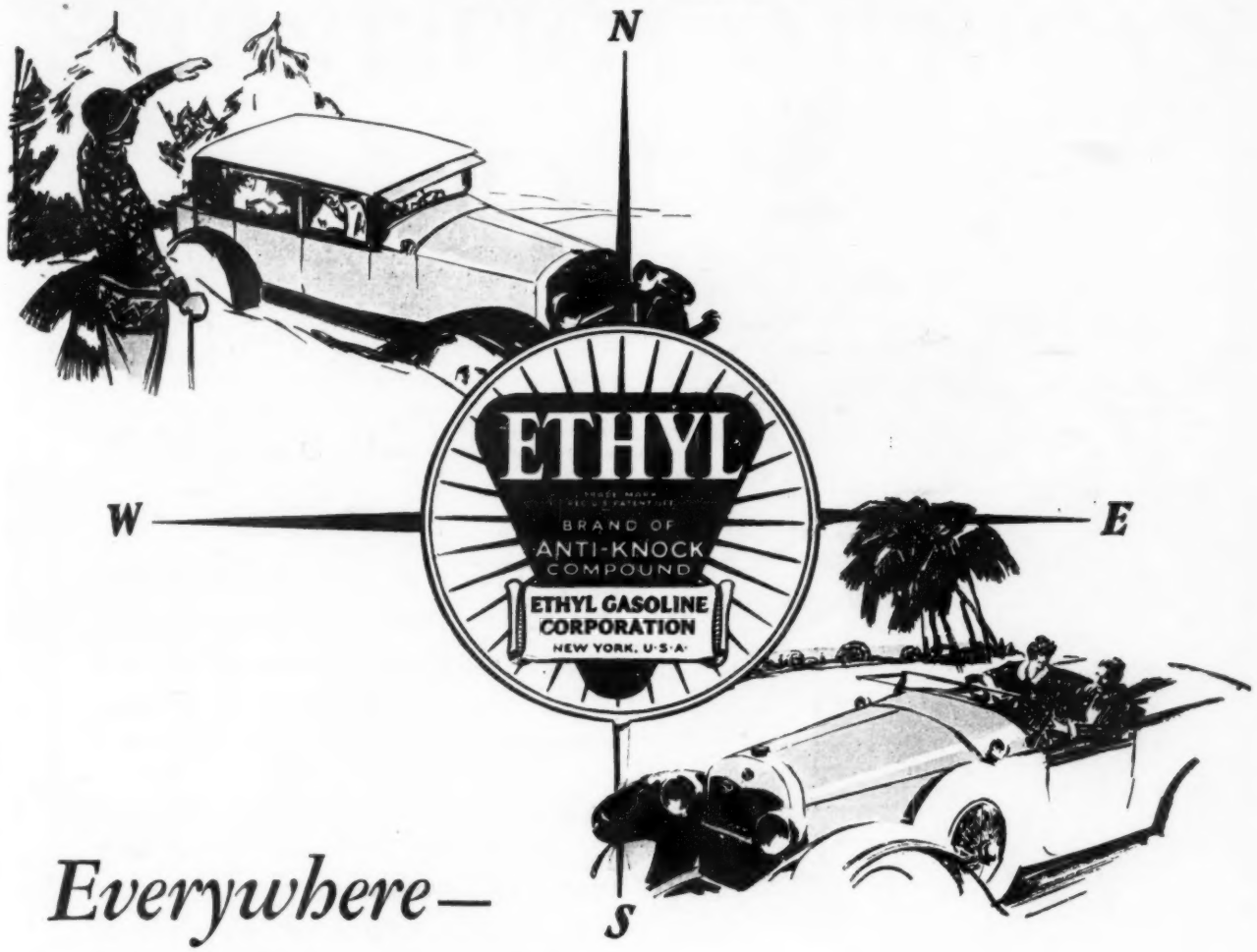
Nothing Is Apt To Cost So Much As A Bearing That Cost So Little



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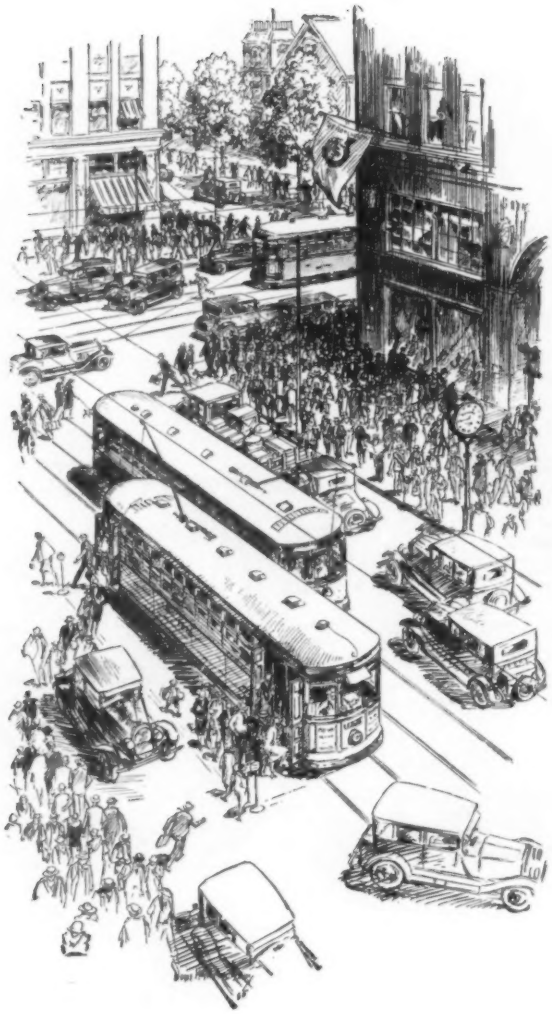

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The street car is handling the crowds. Hundreds of capable and far-seeing street railway executives are busy modernizing equipment and improving schedules so that to-morrow and the day after, winter and summer, this essential public servant may do its work even better and win a still larger measure of popular coöperation.

The next time you board a street car, notice how smoothly it starts and stops, how quickly it gathers speed. Much of this improved equipment carries the General Electric monogram—the same monogram as on the efficient and dependable electric appliances that save time and labor in the electrified home.

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SCIENTIFIC AMERICAN

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November 1928 — *Edited by ORSON D. MUNN* — *Eighty-fourth Year*

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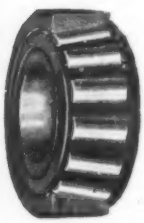
COVER

On page 430 appears an intensely interesting article dealing with the fauna of the caves of the Ozark Mountains. One of the little creatures of this region that the author brought back with him is the salamander *Eurycea lucifuga*. This tiny creature—it is only between three and four inches long including its tail—has lost neither pigmentation or eyes, as have many other habitual cave dwellers. Read about these unusual animals in the article mentioned.

Vote The Straight Timken Anti-Friction *Ticket*



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All Industry is financially interested in placing Timken Bearings in important locations such as line shafting, machine tools, rolling mills, rolling stock, electric motors, road building machinery, oil drilling equipment, conveyors, farm implements—in short, wherever wheels and shafts turn. Timken electric steel, Timken tapered construction and Timken *POSITIVELY ALIGNED ROLLS* act as a continual pledge of permanency.

This exclusive combination is well qualified to bring down maintenance cost, slow up depreciation, increase precision, save power, increase production, and cope with thrust-radial load and shock from any and all directions.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

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Looking Ahead *With the* Editor

What's Going On in Europe

AMERICA has no monopoly on scientific achievement. Knowing this, SCIENTIFIC AMERICAN keeps Europe, the greatest outside field, under constant observation. Accordingly, when the British Association for the Advancement of Science recently met in Scotland, one of the editors, Albert G. Ingalls, attended. Afterward, Mr. Ingalls toured the continent, going to centers of learning, industrial cities, et cetera, taking notes and contracting for future articles. As a result, some interesting material is in store for our readers.

Carnivorous Plants

THERE will be published soon an illuminating description of the bladderwort, in many respects the most remarkable of the animal-trapping plants. Totally devoid of roots, it drifts in sluggish waters and captures its prey by means of a bladder-like appendage. Small crustaceans, eel-worms, et cetera, on touching the hairs about the mouth of this bladder, find themselves entrapped as it suddenly distends and sucks in water. The tiny animal is then digested by the plant.

Noise

NOISES are biologically harmful because they are an inborn stimulus to cause the fear reaction, according to an article ready for publication. The squeak of a file causes a chill to run up one's back; a pistol report causes an involuntary jump; and so on. The article tells of research indicating that, although man seems fully able to accustom himself to modern noises, his efficiency is really greatly lowered by them.

Whence Came Petroleum?

PRACTICALLY irreconciliable are the theories as to the origin of petroleum: the organic and the inorganic. After many years of discussion and study, the question still remains unsettled. Is oil an original substance; is it of rock origin; or was it once living matter? An article on hand cites theories, tells the why and wherefore of various views that are entertained, and points to the conclusion, widely accepted by scientists today, that petroleum is of organic origin.

Wide Utilization of Spectrographic Analysis

Quartz spectrographs are being used by many concerns that find it necessary to identify unknown substances at a minimum expense. In the stock room of one, some chemically pure platinum became accidentally mixed with some that was slightly impure. The spectrogram taken by them, enabled them quickly and easily to separate the two. An article soon to be published describes the instrument and how it works.

Every Issue Fully Illustrated

¶ *"But are you sure?"*
"Certainly. I saw it in the SCIENTIFIC AMERICAN. *A four-dollar-a-year subscription gives me the facts I want to know—and they are authoritative."*

Among Our Contributors

P. Cormac

When it comes to questions of engine balance, wheels, and the like, nothing, not even the most involved mathematical determination of some obscure factor, is too deep for Professor Cormac. To him, these subjects—on which he has written erudite books—are so fascinating that, where another would theorize and let it go at that, Professor Cormac digs in and gets down near the absolute bottom of things.

G. Kingsley Noble

Dr. Noble is an authority on reptiles. He has discovered independently a method of preserving the soft tissues and organs of reptiles, et cetera, by a process of paraffin infiltration. Dr. Noble has accompanied several expeditions as zoologist and has visited Guadeloupe, Newfoundland, and Peru and has traveled extensively in the United States in connection with his museum work. He combines his scientific observations with the spice of thrilling adventure.

Donald A. Laird

Industrial psychology has become a distinct profession. At Colgate University where much is made of psychology, Professor Laird heads the laboratory. He burrows into things most industrial workers take for granted and comes up bearing secrets worth many dollars to employers, industrialists, and people. Professor Laird is also editor of the magazine, *Industrial Psychology*, a welcome monthly arrival in our office.

Oliver B. Finn

Like many others who, in their spare moments, ride a hobby for edification and diversion, Mr. Finn, although a mining engineer, gets a great deal of enjoyment out of the study of plants. In this issue he has given us an interesting description of one of nature's most curious plants.

Paul R. Heyl

By this time Dr. Heyl of the Bureau of Standards, and our corresponding editor, is well known to our readers for his terse lucidity. His present article describes experiments tending to substantiate the concept of the Schrödinger wave atom, the theory of which he explained in July.

Almost Over Night

Los Angeles County Becomes America's Second Tire Industry Center

FOLLOWING the pioneer lead of Samson Tire & Rubber Corporation, Goodyear, Goodrich and Firestone have each established great tire plants in the metropolitan Los Angeles area—and still other major developments are now in progress.

As a result, Los Angeles County is today the second largest tire center in America, and present progress bids fair to make it first. Why did these great plants locate here? Because exhaustive investigation disclosed these advantages:

—lowest unit production cost in America.

—a higher standard of labor; ideal working conditions.

—lower plant maintenance expense and less plant depreciation.

—freedom from labor troubles.

—saving of expensive, long haul across country to supply Western markets.

—a tremendous tributary market quickly reached and more economically than from any other Western distributing point.

—big, concentrated market with exceptionally high per capita buying power.

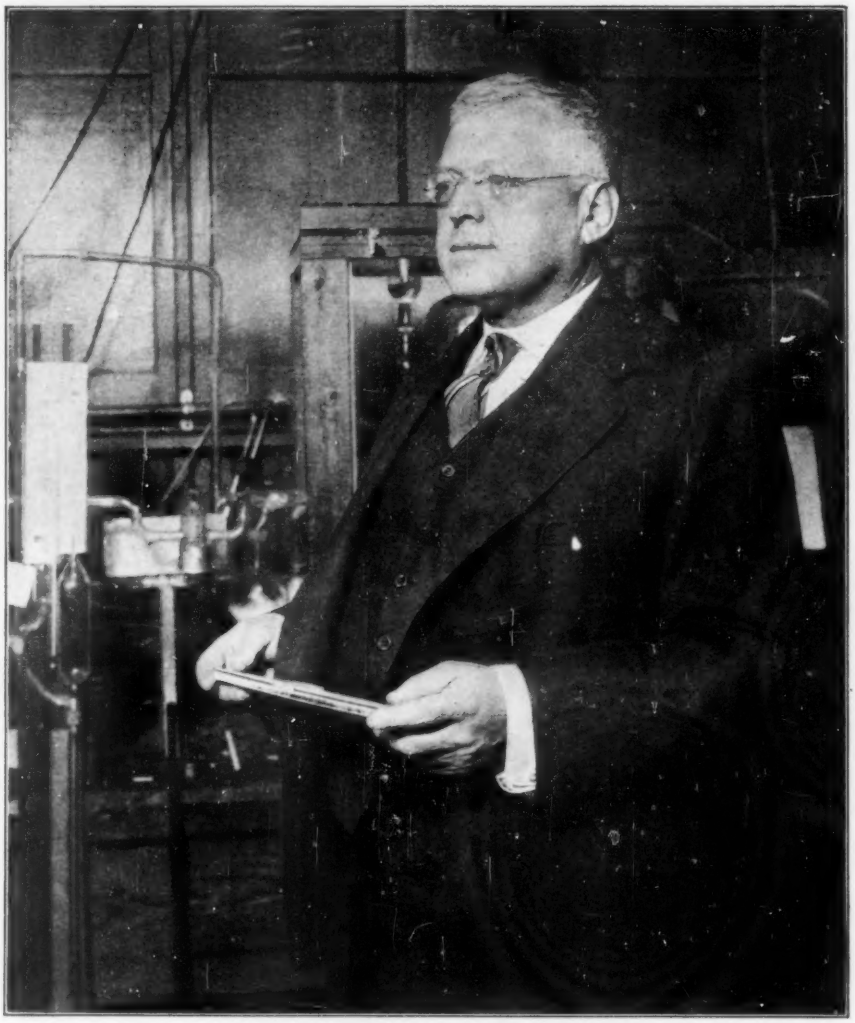
—smaller plant investment necessary.

—excellent transportation facilities by rail and water.

—abundant cheap power and water.

These same advantages are bringing other great industries here. For specific information regarding manufacturing opportunities and distribution advantages in Los Angeles County, address Industrial Department, Los Angeles Chamber of Commerce.

INDUSTRIAL LOS ANGELES

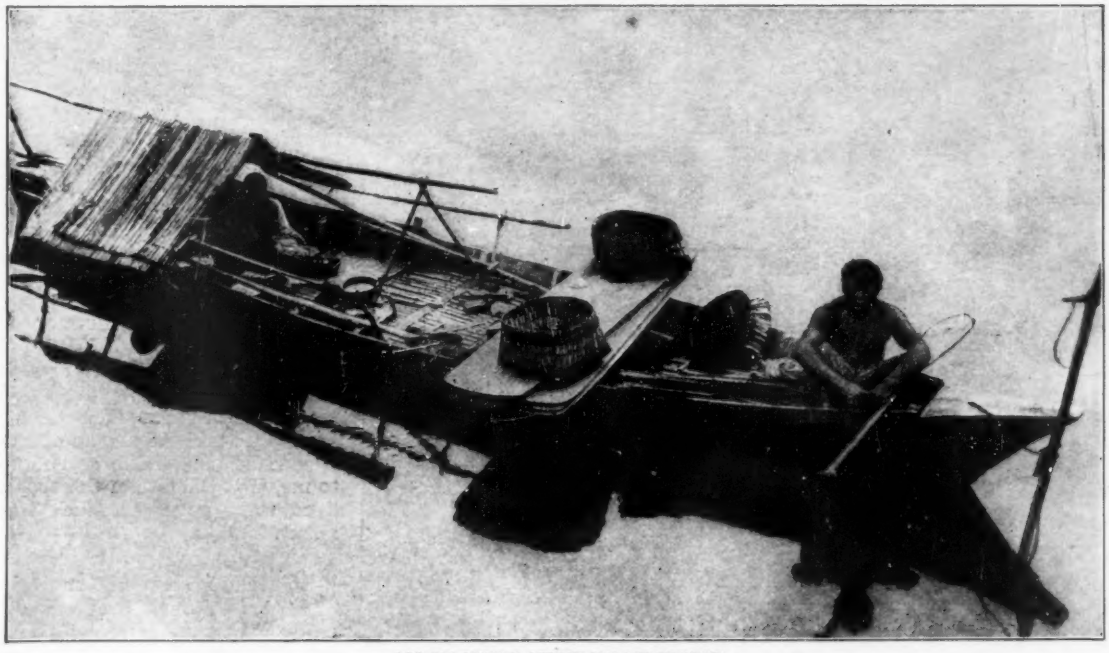


Professor Vladimir Karapetoff

THE scientific engineer whose picture is shown above has been a professor of electrical engineering at Cornell University since 1904. He was born in Petrograd (now Leningrad), Russia, in 1876, studied engineering there and in Germany, and came to this country in 1902. He is one of a few known men to possess a natural "compartmental mind." As a result, he is equally at home in several quite distinct forms of activity, and is a prolific writer. He is the author of seven books and of some two hundred articles and other contributions to the press. Of late years he has been interested in problems of atomic physics, mainly with the view to bringing some of the important recent discoveries and theories into engineering practice. The picture shows him in his laboratory at Cornell working on effects of electrical corona discharge upon insulating oils. In 1922 Professor Karapetoff received an International Montefiore Prize for electrical papers; in 1927 he was awarded the Elliott Cresson Gold Medal, "in consideration of the inventive ability, skill in design, and detailed theoretical knowledge of kinematics and electrical engineering, displayed in the development of computing devices."

Tungkal, a Village of East Sumatra

THE village, a part of which is shown in the above illustration, is situated at the beginning of the delta of the Tungkal River, on the coast of east Sumatra. All of the houses are built from 12 to 18 feet above the water level and are reached by only two flights of stairs. According to the author of the article on the Orang Lahut, beginning on the opposite page, this village lies high and dry at low tide, but when the tide flows, the piles supporting the buildings are under water. The inhabitants of this and other Malay villages are rather well-to-do because of their traffic in sea food and products of the fields and forests. These are sold to Singapore.



AN ORANG LAHUT BOAT-HOME

These interesting and unusual people spend their entire lives in boats such as this one, carrying their entire household equipment with them. Toward the center of the boat is a crude fireplace, built of stones on bamboos, on which a small cooking pot may be seen

The Orang Lahut

A Peculiar Malay People of Sumatra Who Pass Their Entire Existence in Boats

By DR. TASSILO ADAM
Late Ethnographer to the Dutch-Indian Government

AFTER having passed several weeks in the virgin forests of the hinterland of Djambi in search of the Kubus, (See SCIENTIFIC AMERICAN, October, 1928) the next thing to do was to visit the Orang Lahut on the coast of east Sumatra, along the coasts of the Djambi and Indragiri districts.

With the exception of the short description in the encyclopedia of the Dutch Indies, I have not been able to find any mention of them, not even in the voluminous library of the Batavian Society for Arts and Sciences, and my searches after photographs of these people remained without result, even in Holland.

IT is, of course, no easy matter to develop photographs under such exceptionally difficult circumstances as are found in this tropical country, for the temperature of the water renders it difficult to get good results. Be this as it may, I am glad to be able to show at least something to make this highly interesting people better known. I must extend my sincere thanks here to the Dutch-Indian Government, especially to the art-loving General-Secretary, Mr. Erdbrink, who commissioned me to make these travels, and who gave me permission to publish these pictures.

The Resident of Djambi, Mr. Petri, loaned me the fine seaworthy government steamer *Robert*, and one fine day I set out in quest of a peculiar primitive people who pass their whole lives in small boats, cruising along the coasts.

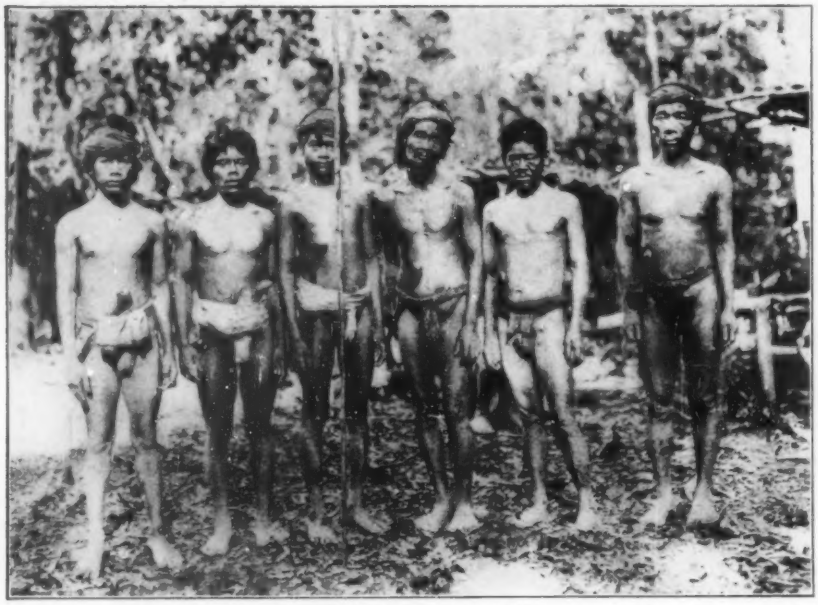
At first we steered from the delta of the Batang Hari River, along the coast to the mouth of the Tungkal River, hoping to find the looked for water-dwellers there.

Where the delta of the last-named river begins, there lies the village of the same name (Tungkal), which makes quite a peculiar impression. Although it is in direct connection with Singapore by the steamers of the *Kgl. Paketvaart Mij.* and has in consequence also its own custom house, it retains its very characteristic original form. Certainly, like all these concealed lying villages along the east-coast of Sumatra, it has been a pirate settlement. All the dwellings and the few shops are built at a height of 4 to 6 meters above the water, also the "streets" there lie at the same height, on piles. At two places only did big stairs lead to the river, where the steamers, and other more or less large vessels, especially Malay *djunks*, lie.

The Malays living in this pile-built village are well-to-do through traffic in oysters, which are found there in great quantities and are sold to Singapore; also fresh and dried saltfish, crabs, and shrimps, besides agricultural and forest products of the population in the hinterland, the lucrative commerce in rubber of more recent time not to be omitted. These are their good and regular sources of income. Although accustomed to deal with Europeans, they are reticent, spiteful to some degree, and certainly but little helpful.

WHEN it is low tide, these hidden villages lie quite dry. At high water the piles supporting the houses are under water, but at low tide a darkish grey mud, swarming with shrimps, sea-spiders, snakes and other creeping small animal life, is to be seen. The mouldy smell of the air is abominable, and there are legions of mosquitoes, so that one involuntarily asks one's self why people have settled in such unhealthy, inhospitable places of the world.

On the whole east coast of Sumatra, hundreds of kilometers of which form



AN ORANG LAHUT GROUP

Their only clothing consists of a tjawat *or loin cloth drawn between the legs and fastened around the loins. The hair is kept cropped short with a crude trade knife seen thrust in the "belt"*

sometimes only swamp and mud-districts, thousands and thousands of crocodiles live, and it is not to be wondered at that many people lose their lives every year by these abominable dwellers of the mud.

The population does nothing against these animals, and seeing with what carelessness these people bathe in the rivers, whilst everywhere such monsters are to be seen, sometimes swimming in the river, sometimes basking in the sun ashore, one can only regret the fatalism of the natives. Only if somebody has disappeared in the river, is a hunt made after the evil doer and the animal is *pantjenged*. That is to say, it is caught by a barbed hook, with a white hen as a bait, then dragged from the river by means of thick rattan lines, and killed by the male relatives of the lost one, who spear it with lances and then hack the body to pieces.

IN such highly dangerous localities as this do human beings live, but not even then in pile built villages where they can protect themselves against all the animals and mosquitoes. No, there are people who pass all their lives in small boats and are even born in them. These are the "Orang Lahut" (sea-people). An English explorer very happily named them "gypsies of the sea."

After I had cruised for some days along the coast of Tungkal, the *turagan* (Malay for captain) called me one day and made me look through the telescope. From a nook of the great swamp, grown over with Nipa-palms, there emerged two small boats. "These must be some of them," he observed, "for, with the exception of these savages, nobody goes in a small boat about this region."

Quickly my motor-boat was alongside the steamer, and I was soon as near the small vessels as possible. Only my Malay servant and a Malay sailor who served as interpreter, were with me. The latter, the *turagan* told me, was a descendant of the Orang Lahut and was the only one who could converse with them. This youth had already attracted my attention by the dark color of his skin and by his vivacious eyes.

WE had hardly arrived near the boats—they made no attempt to depart—when we saw one man sitting at the end of each boat with a short paddle in his hand. The young sailor recognized at once his quondam tribesmen and whispered to me: "Master, these are the real ones." I told him to request them to come to Tungkal, which they also promised to do. "Will they really come?" I asked. "Master, whatever they promise they will also do. They will arrive this evening, surely."

"In each boat there is only one sitting. Are there no more of them in it, perhaps under the little awning of katjang-mats?" I inquired of my companion. "Oh, master," he replied, "there is certainly a whole family of them, but they did not like to be seen. They did not know yet who is in the motor-boat, and when they see you they are certainly too much afraid to come forth."

The two oarsmen with whom I had there come face to face, were already a good reward of these adventurous cruises. I was quite enthusiastic about this discovery! What people they were! The skin quite dark, a face burnt and withered by sun and weather, a heavily developed upper-body, piercing, cunning looking eyes, short, frizzled unkempt hair—the first impression was the very opposite to my first encounter with the Kubus, the lowly inhabitants of the virgin-forests in the hinterland of Djambi.

We took our course back to Tungkal and waited for the two little boats. As they had not arrived late in the evening, I had little hope that their owners would keep their promise, and I laid myself down in bad humor on my truckle-bed on the deck of the *Robert*. Owing to the bad temper I was in, the terribly annoying mosquitoes upset me more than usually. The thick, close swamp air and the stench of the mud seemed so unbearable and unhealthy to me, that the fate of the people who lived there gave me much to think about.

WHEN I awoke next morning, still tired from the abominable air, all dismal thoughts were gone at once, for to my greatest joy I saw the two small boats lying alongside of my steamer. Like all primitive people, these water-dwellers were also astir at the first breath of dawn. I should have liked to climb down at once to witness their morning toilet, but . . . leisurely, only quiet, quiet . . . otherwise the game is up.

The boat is the dwelling in which

HIS TOES WORK

Note the distortion of the big toes due to using them to hold position in the boat

these peculiar people are born and pass their whole lives. Here is to be seen the whole domestic paraphernalia. Forward are three big baskets for storing oysters, crabs, shrimps and prawns. Then comes the fire-place. On split bamboos lie some stones on which the cooking pot stands. The fire is lit with matches which they get by barter. Behind stands the big tureen with rice, which is also acquired by bartering. Then, on a mat in front of the woman, stands the vessel (Malay) containing the ingredients for chewing betel.

THE dress of the men, if they do not happen to trade at a big place like Tungkal, consists always only of the *tjawat* cloth which is rolled together, drawn through between the legs and fastened round the loins. With these genuine Orang Lahut I did not find any ornaments; only one more civilized woman wore ear-appendages.

The bodies of these people are highly interesting. Through continuous living in boats and frequent paddling, the upper portion becomes very heavily developed. The musculation strikes one at once, but particularly the hands which attain quite incredible dimensions with some of them. The head has unkempt hair, hardened by the sea-air and cropped short with the knife, and sometimes with a tendency to frizzle. Of unwelcome tenants on these otherwise wholly uncultivated bodies there are many. With the women the hair, which is not very long, is worn *gondeh* in the Malay style—that is, drawn through a thin thong at the back of the head, to prevent it from hanging down. The children have their hair cropped short with the knife.

LADY OF THE BOAT

This is a close-up of the Orang Lahut woman who is in the boat shown on page 393

In contrast with the upper body, which as a result of the man's work is quite extraordinarily strongly developed, the lower part is sadly under-developed, through the life in the boats, the bent, sitting attitude and the small use of the legs. However, the native loves to make his big toe work, a facility which is particularly useful here in the boat for keeping to the crosspiece of wood, and its peculiar position and strong development is not to be wondered at. My attention had already been drawn by the *turagan* to the remarkable feet of these people, and when I saw this distortion also with an old man, he assured me that this phenomenon occurred frequently among this little tribe.

Disfigurements of the body there are. It is, however, very difficult to fix a certain rule in this respect. With the men circumcision is known, when they have become Mohammedans, which, however, does not always

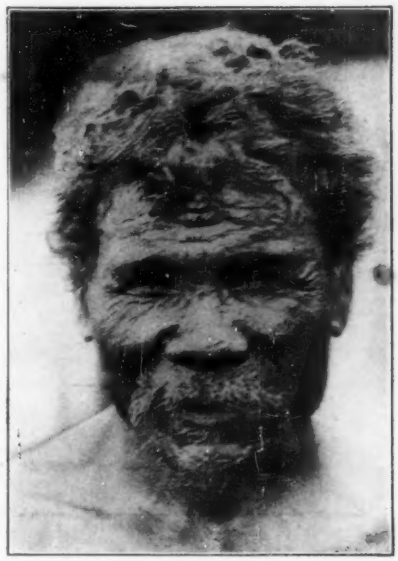
HUGE HANDS

Due to a lifetime spent in paddling, the Orang Lahut hands are incredibly large

seem to be the case. In any case Islamism is practiced only in a very superficial manner; of a religion as such they know absolutely nothing. With men as well as with women one sees filed-off teeth.

From all my researches it is to be concluded here, the same as with the Kubus, that we are dealing with an extremely primitive people, although the Orang Lahut in consequence of their intercourse with Malays and Chinese, rare and very superficial though it is, stand on a somewhat higher level.

These people have no settlements, at least not the genuine ones which I was looking for. There are, however, many of this people who live in pile-dwellings and do a regular traffic. These are registered, pay taxes, are Mohammedans and lead the same life as Mohammedans. The genuine Orang Lahut, however, lives only in a boat,



FRIZZLED HAIR

The salt air tends to harden the hair, which is unkempt and crudely cropped short

only comes to the villages with a good catch to barter, has no tribal chief and also has little intercourse with his tribesmen, although he is able to state rather accurately at which places those that live in boats are staying.

About customs at births I could learn nothing; it seems to take place just as simply and without any ceremony, as with the Kubus.

At marriages the Islamitic laws are kept by those who call themselves Mohammedans. The young man who wishes to marry his elected one asks her parents for permission.

IN case these are agreeable, the youth has to pay down 12 Dutch dollars (equal to 30 guilders); that is, if he is able to. But he may also purchase on the installment plan and make time payments. But in this case he cannot get a divorce unless the full amount is paid to the wife. The *hakim* performs the marriage ceremony. If the husband wants a divorce, then he loses the 30 guilders paid, but if the wife wants to get divorced, then she must pay 120 guilders to the husband, which she will be able to do only in the rarest cases. If the man gets his divorce, then he may decide whether the children must go with him or whether they may remain with the mother; if the wife obtains a divorce and has paid the 120 guilders, then the children may choose for themselves. I think, however, that it is better not to give too much credence to these tales, and to take it rather that, the same as with the Kubus, not much ceremonial is required for a separation.

I could find nothing with respect to religious habits, nor anything about shamanism or other heathen customs. But that the people are highly super-

A MALAY VILLAGE

From this point, the author of the present article set out in his search for members of the Orang Lahut tribe. Some of the more civilized of these people live in these villages with the Malays

stitious, the following may prove: I wanted to take as many photographs as possible. The quite old man had absolutely no mind for it, and the women just as little. It wanted all my patience and persuasive skill, also many

A TYPICAL ORANG LAHUT

This is a close-up of the tribesman with the distorted big toes, shown on page 394

presents of rice, fruits and clothes, until at last the ice of resistance was broken. But when I wanted to begin, there came protests again, and quite a secluded spot to be searched for, where nobody could see that they were photographed by me. I went in advance with some of the steamer's crew who carried my apparatus, but . . . nobody followed after: they did not go by way of the high flight of stairs from the river to the village. "No, Master, that they will never do; they are much too afraid for it," said my interpreter. "They will all climb up the smooth piles, 15 to 20 feet high, even the old man and the women." And so it happened, too! Covered all over with mud, they all drew themselves up the slippery piles. It was really comical to look at. To take the photos was a very difficult task, for apart from the contrariness of these people, rain set in, which spoiled much for me.

For the rest, see the photographs. These tribesmen seem to be as good-natured creatures as the Kubus. They are no sea pirates, but carry on trade in a very peaceful manner, but only with persons who are known to them.

If anybody dies and it happens to be in the neighborhood of one of the places where they always deliver their fish, then he is buried with Mohammedan rites. If, however, they are out at the open coast and anybody departs this life there, then he or she is only covered up in the mud. I believe I may assume that this mode of burial occurs by far the most frequently.

To my great regret, I learned when it was too late to take a photograph, that these strange people have the following peculiar habit: during low tide they take a smooth board and glide on it like on a ski-runner with an incredible rapidity and agility, between palms and shrubs along the coast in order to catch small animals with their primitive tools, knives and short-handled nets. Thus they go right through the mud-lands peopled with innumerable crocodiles, without being afraid of the many dangers by which they are beset.

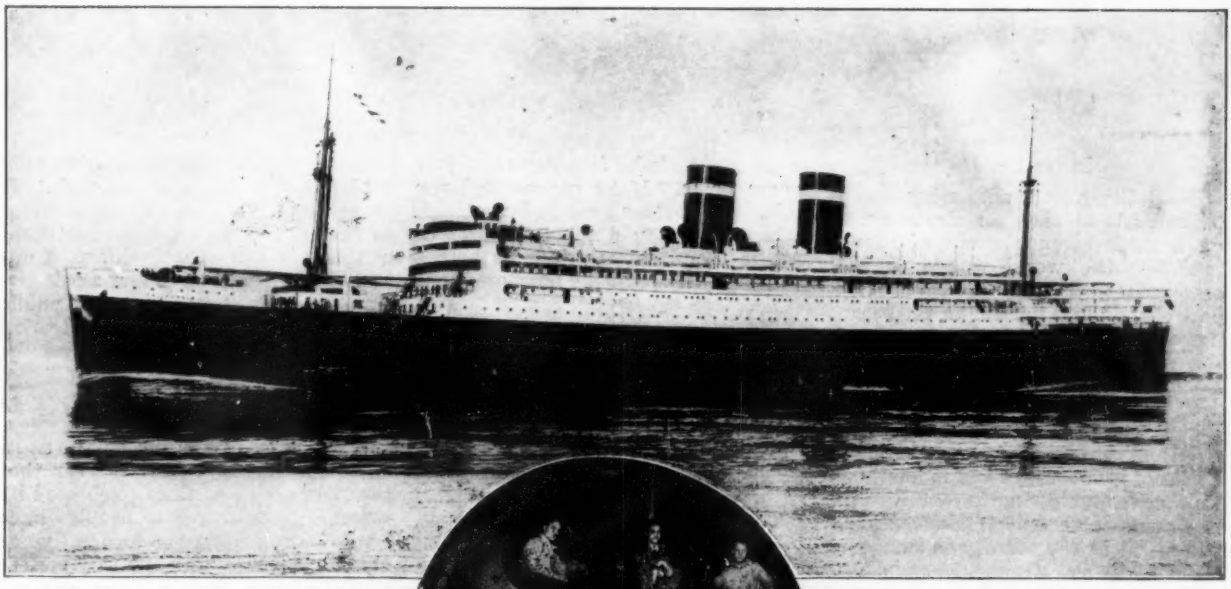
THERE are only few of the quite genuine "savage" Orang Lahut still living, according to statements given me—on the whole coast of Djambi and Indragiri 50 boats at the utmost, with four people in each on an average; thus perhaps 200 souls all told. The rest have their settlements, of which I visited some at Kwalla Retel and Solek. These, however, live like Malays and therefore they were not of such interest to me.

Just as their language is Malay, with foreign words and a foreign intonation, thus is their whole build and psysiognomy Malay. It is, however, unfortunately an unsolved problem, whether they belong to the same group as the Kubus; whether they are of Malay descent, and have been abandoned by these; or whether they belong to one of the groups on the islands of Banka, Biliton or on the Riouw Archipelago.

When will these questions at last be thoroughly investigated? Is it not of scientific import to make researches as long as there is still a possibility for it? Soon the time will come when nothing will be left of this peculiar, remarkable little tribe, the same as with the Kubus. They are doomed, just as these, either to become extinct, or to be assimilated by the Malay and Chinese settled on these coasts.

ORANG LAHUT BOAT-HOMES OUT FOR A SAIL

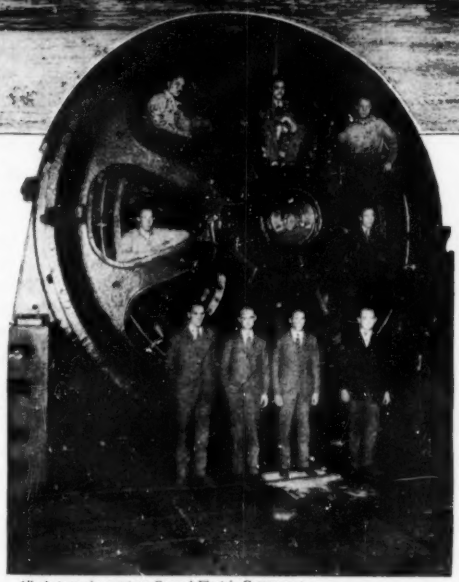
World's Largest Electrically-Propelled Passenger Ships



"S. S. CALIFORNIA"

At the time of its launching, this was the largest electrically-driven passenger ship

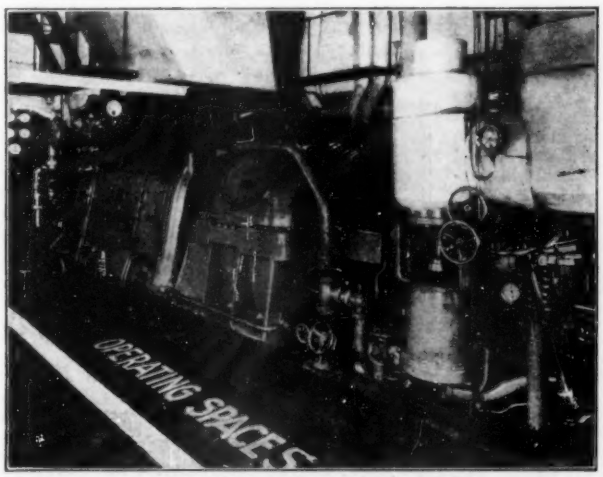
LESS than a year after the launching of the *California*, first of three turbine-electric passenger vessels for the International Mercantile Marine Company constituting a total tonnage of electrically propelled ships greater than ever before constructed by a single company, the second ship, the *Virginia*, was recently launched at Newport News, Virginia. It is larger than the *California* but will be duplicated by the third, the three being the largest commercial steamships ever built under the American flag. Each of the twin screws on these ships is driven by an 8500 horsepower motor. Two marine-type, General Electric Company turbines, each rated at 8500 shaft horsepower, are directly connected to two alternating current generators on each ship. These generators are rated at 5250 kilowatts at 3700 volts, their maximum continuous rating being 6600 kilowatts at 4000 volts. Control of the propulsion machinery is accomplished by a main operating control panel divided into two sections, one for main high-voltage control and the other for control of low-voltage field circuits. The ship's rudder is controlled by means of a hydro-electric steering gear designed to stand the pressure incident to putting the rudder from hard-over to hard-over in 30 seconds at a ship speed of 18 knots. The *Virginia* is 612 long, of 35,000 tons displacement.



All photographs courtesy General Electric Company

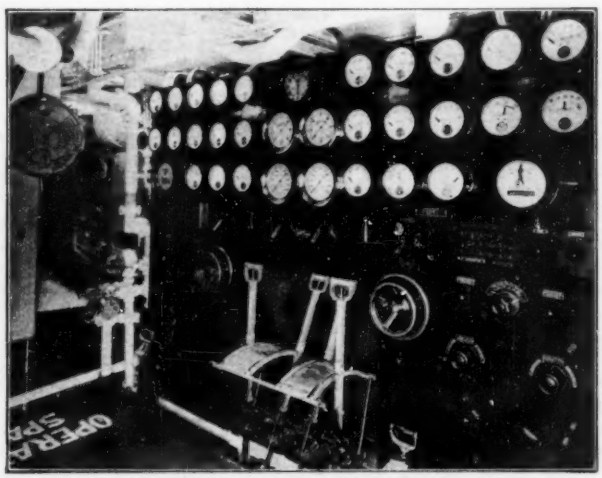
MAIN PROPULSION MOTOR

Striking view of one of the main motors for the Virginia posed in the factory where it was built



PROPULSION TURBINE GENERATOR

Each marine type turbine is directly connected to a generator which supplies electric current to the 8500 horsepower propulsion motors



MAIN CONTROL SWITCHBOARD

Meters of all kinds, thermometers to show temperature of motor fields, revolution counters, and signal dial are all concentrated on this board

Our Point

Is He Dead?

INTO the North, across icy wastes and frozen seas, an airplane flew on a noble errand; weeks of silence followed; the world waited, hoped, searched; then came discovery of a part of the plane floating in the ocean: mute testimony of disaster; and, sorrowfully, it was conceded that Roald Amundsen and those who went with him were lost. This modern Viking, eccentric at times, both criticized and beloved, but always hailed as a man of iron courage and indomitable will, a veritable Spartan of a man, had come forth from retirement and had flown to the aid of the survivors of the *Italia* catastrophe.

When but a boy, Amundsen "irretrievably decided to be an Arctic explorer," to use his own words. He trained rigidly until his body was a marvel of physical perfection and hardened almost beyond belief. Thus in later years he was able to conquer, with slim resources, in the fishing smack *Gjoa*, the Northwest Passage that had defeated others who had the resources of governments behind them. He was first to reach the South Pole, first to attempt an airplane flight to the North Pole, and finally, a member of the first party to reach the North Pole in a dirigible.

It is barely possible that Amundsen and his companions survived whatever disaster befell their plane, in which event his resourcefulness, courage, and great endurance may even yet bring the group back to civilization. But, dying where he has lived and striven and suffered, his body could find no more appropriate resting place. And in death, his greatness of soul marks him as a character more worthy of emulation even than during his courageous life.

Aerial Signposts

IN these columns in the September issue, we made mention of the need of this country for more airports, and even at this writing, the reports from various parts of the country are encouraging. Particularly is this true of Southern California, where there are some 75 flying schools. In the entire state there are a total of 136 landing fields. Other parts of the country are also doing their bit to make flying more popular.

But there is one other phase that has not received the attention that it should. Flying fields are of no value to an aviator who is not sure of just where he is. If he cannot find the field, it is obvious that as far as he is concerned, the field might just as well not be there. This brings us to the fact that there should be more signposts for the aviator. In the early days of motoring, lengthy trips were handicapped by the facts that there were few road signs and only poor maps. But these have been overcome to a great extent. Just such a process of evolution must be gone through in the case of flight. Every large town should have a prominent sign, visible from a great height, which should include an arrow showing the direction to the nearest airport or safe landing field. (See further comment on page 467)

Nor is the sign alone enough. It should preferably be lighted at night so that it will be capable of 24 hour service. When every village, town and city has such signs and a safe airport, then will the general public feel that aviation has developed to an extent where everyday flying can be considered.

Reclaiming the Desert

ONE of the most ambitious plans that man has ever considered is that for reclaiming part of the waste land of the Sahara Desert by means of, not irrigation in the general sense of the word, but actually changing the climate of the region.

In northern Africa, south and east of Biskra, are many large dry lake beds, connected by equally dry stream beds. All of this territory is below sea level, and the present plan is to construct a canal to the Mediterranean Sea. When this is finished, the waters of the sea will flow through the man-made channel and fill the below-sea-level basin. It is said that the result will be an inland sea with an area in the neighborhood of 30,000 square miles. Thus far will the work of man go in the achievement of the desired results. From here on nature will take up the burden. The dry winds sweeping up from the south, across this new inland sea, will pick up evaporated moisture, and carry it to the range of mountains to the north. Here the moisture will fall as rain, and the entire climatic conditions of the region will be changed.

It has been proved that the land of the section under consideration is inherently fertile, needing only water to render it fruitful. If this project is carried through to a successful conclusion, and its magnitude should not be an obstacle to present-day engineering, there is no doubt that northern Africa will bloom forth as one of the garden spots of the earth, and will become one of the important agricultural centers.

Conservation on the Footplate

THE railroad has been with us so long—it was only last year that the Baltimore and Ohio celebrated its centenary—that most people have come to look upon the locomotive as not only a handsome but a very perfect machine. But of late years, our engineers, while admitting its beauty, have questioned its perfection. They always knew that it was a voracious coal consumer, and under the keen spur of necessity, they set about the task of producing a locomotive that would give a maximum amount of power for a mimimum expenditure of coal.

It is amazing to reflect that, not so many years ago, the average locomotive was burning up from six to eight pounds of coal per horsepower-hour; and this at a time when the best ocean liners were burning only one and one third pounds, and the big electric generating stations only one pound per horsepower.

Today, the latest locomotive, in spite of the fact that it is, in itself, a complete power station, whose weight it must carry and move at speeds of 60 to 70 miles per hour, compares most favorably in economy with the average factory steam plant.

Too great praise cannot be given to the locomotive designers who have wrought this great change in so few years. How was it done? Briefly stated: by using ample boiler capacity and large fireboxes; by an enormous increase in steam pressures, with the use of ample superheat; by using multiple cylinders (three and even four), and improved valve gears; and last (let us not forget this) by the intelligent co-operation of the men on the footplate.

And the result. We cull the following from an Interstate Commerce Commission report — an infallible authority. In the first four months of 1927, the consumption was 2,200,000 tons of coal less than for the same service in 1926. For the whole year

# of View

the total saving was estimated at 17,000,000 dollars. Compared with 1920 this would represent a saving of about 92,000,000 dollars.

Do the railroads get the benefit of this? Ah, no. Increased taxes, declining rates and advancing wages are causing operating income to decline.

Radio Control

OCCASIONAL press reports relate the results of experiments in radio control of moving objects—automobiles, airplanes, and ships in particular. One of the latest deals with the maneuvering of a German battle-ship, controlled from another ship. Despite more or less deprecatory editorials in some of our foremost daily journals, these gradual developments may have a far-reaching significance. Their possibilities are not to be overlooked if we are to make full use of the advantages of radio.

True, in the present stage of the art, radio control of battle-craft from an enemy base can be combatted by a radio "barrage," and would also be dependent to some extent on weather conditions. But as research progresses, who can say what discoveries may be made with the ultra-short waves, wave changing devices, and other means of combatting these deterrents?

Furthermore, actual use of radio-controlled battle-craft is not the only object of experiments along this line. As Rear Admiral Fiske, U.S.N., Retired, pioneer inventor in the realm of radio control, states, the main reason for similar experiments performed by the United States Navy was for the purpose of obtaining data in regard to the action of gunfire on battleships while they are maneuvering—something that would be impossible if the ship had to be manned by human crews. With radio control, a target ship can be put through its paces while under fire, without danger to human life.

Neither the possibilities of radio control for actual battle use, nor for peace-time tests are to be overlooked. Radio may become a vital factor in the events of the world, aside from its use as a means of communication. Watch the developments.

Highway Safety

THE state of New Jersey has recently put in force a new set of highway laws superseding those which, in part at least, were relics of the horse age. The new laws provide, among other things, for higher legal speeds in city and country, control of pedestrian traffic, standardization of traffic signals, regulation of trucking on the highways, and other points too numerous to detail here. The new laws have many friends and many enemies, but if properly enforced and observed, they should have the effect of materially speeding up traffic and relieving congestion. If they accomplish this, and at the same time add to the safety of all concerned, they are well worth while. And we think that they will do all of this.

Other states will do well to observe the results of the workings of the new laws, and rejuvenate their own out-of-date traffic rules to conform with present-day vehicles and demands.

No Cure

WE have heard a great deal recently of the efficacy of stunt-flying as a treatment for the deafness of an airplane passenger, and, knowing the hazard of such flights, have wondered how soon disaster would overtake one of these "treatment planes." Just the other day three persons were killed in a crash of a plane in a flight undertaken to cure deafness of a child.

As to the merits of this heroic treatment, it is difficult to arrive at any definite conclusion, but we do know that flying may prove exceedingly harmful. The noise of the engine, together with the rapidly changing atmospheric pressure on the delicate structures of the auditory apparatus, dulls the sense of hearing so that now many aviators are slightly deaf, according to Lieutenant-Colonel L. M. Hathaway, chief medical officer of the Army Air Corps. If aviators are affected in this way, is it not reasonable to believe that stunt-flying as a cure for deafness has slight merit despite the apparent cures in one or two cases? And, naturally, we don't wish to see a recurrence of the smash which killed the three who were "experimenting" with this method of treatment.

The Passing Longhorns

WHEN Gregorio Villalobos, governor-general sent to rule New Spain, landed near Vera Cruz in 1521, he took from his ship some Spanish calves. Their descendants, the famous longhorns, thrived in the New World, spreading over Texas and the Great Plains region of the Far West. From the Gulf to Canada they swept, pressing back the buffalo and the Indian.

The longhorns were long on legs, horns, and speed, but short on beef, and they, too, had to give way for gentler, meatier breeds, and their passing has been swift. Recently, when two forest agents, provided with a small appropriation to buy a few longhorns before the breed had wholly disappeared, began their search in Texas, they were told it was hopeless. The belief was general that not a single longhorn bull could be found in all the wide west.

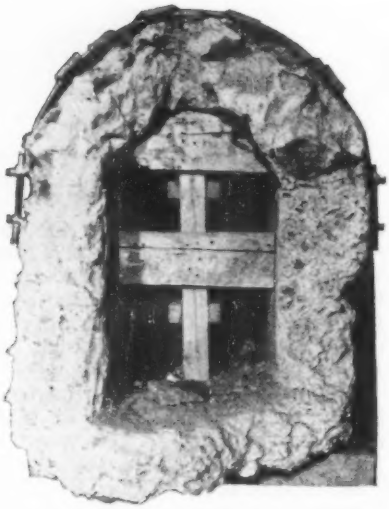
After a long search down in the prickly pear country they found ten cows and a single bull. Then they combed the great range country between Houston and Beaumont and found two more bulls and ten cows. They shipped the lot off to the Wichita National Forest to build up a modest herd of 250 or 300 head.

And so the Texas longhorn at the eleventh hour is saved from total extinction. It is well. In song and story the creature will live as the Republic shall stand, for he is the very bone and sinew of the romantic Wild West that is no more. It is only right that we give future generations an opportunity of seeing him in the flesh.

Gliding

IN our October issue, the "Learning to Use Our Wings" department carried a resumé of the history of gliding. Since then old records for both altitude and distance have been shattered. Probably by the time these words reach our readers new records will supplant those that now stand. But it is interesting to note that Germany is leading in the matter of glider development. And gliders are the basis, the cornerstone, of aerial flight. As a sport, those who have tried it say that there is none more thrilling. And as an introduction to powered flight there is no better way of acquiring "air-mindedness." Let us by all means develop the art in this country. Gliders are cheap to construct, use no fuel, and if damaged are easily repaired. And the lessons learned while mastering flight in a glider are lessons that can be obtained in no other way.

From the Scrap-book of Science



ROMAN CONCRETE WORK

This section of conduit, recently dug up in Germany, is interesting because it is made of concrete similar to modern concrete. It is part of a water supply line 43 miles long which Romans used

Herbert

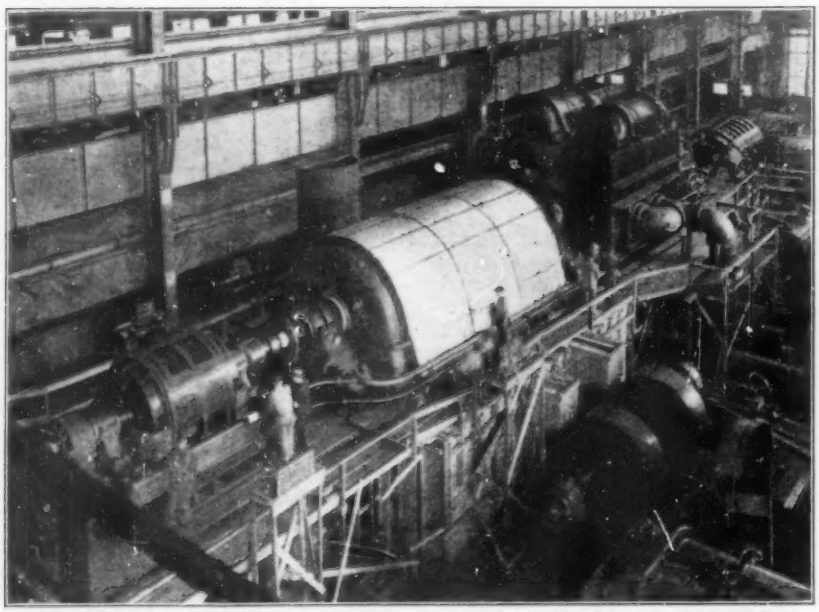
INSULTED BY FUMIGATION

Rather inclined to turn up her nose with haughty indignation, this camel is being fumigated at Hamburg, Germany, before embarking for the United States. The entire body of the camel is enclosed in a huge caisson, hermetically sealed and with only the head showing. A chemical is then shot into the caisson in order to kill all the vermin on the animal

Wide World

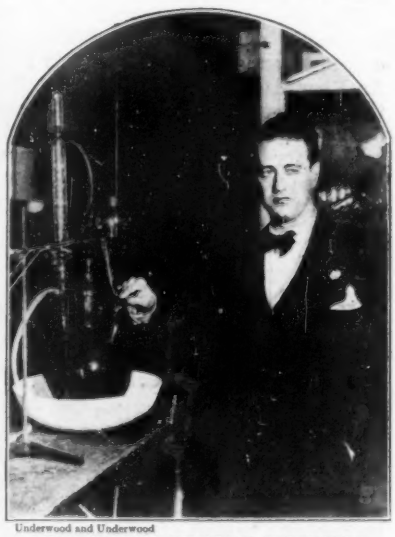
PHONOGRAPH AUDIOMETER

A new device developed by the Bell Laboratories for the quick and efficient testing of the hearing of public school children. The illustration shows J. B. Kelley demonstrating the apparatus at the recent Parents and Teachers Exposition in New York City. Only a short time is required to test a group of 75 pupils



WORLD'S LARGEST TURBO-GENERATOR UNIT

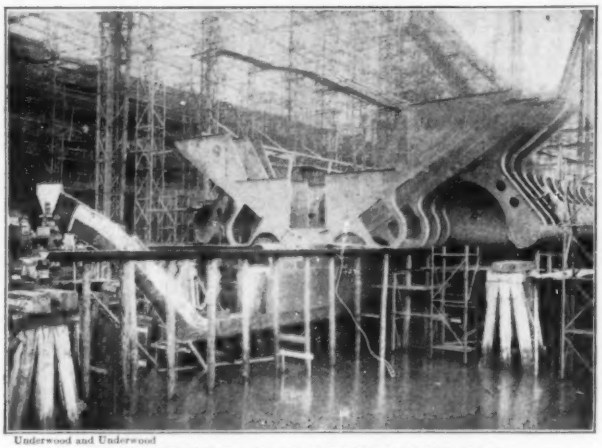
Generator unit for the Long Beach, California, plant of the Southern California Edison Company, having a rating of 94,000 kilowatts, as it appeared when set up in the shops of General Electric Company, Schenectady, New York, for the final complete tests. It was placed in commercial operation during the summer



Underwood and Underwood

TO STUDY SLEEPING SICKNESS

Dr. Warren K. Stratman-Thomas who went to Africa in October to study sleeping sickness under the auspices of the University of Wisconsin and the Guggenheim Memorial Foundation. This disease, carried by the tsetse fly, prevents development of many large parts of Africa



Underwood and Underwood

SHIP STABILIZERS: WAVE BREAKERS

Early construction work on the German steamship, *Bremen*, which was recently launched, showing the longitudinal bulges (not covered at this stage) which are designed to prevent side rolling. The *Bremen* is 937 feet long

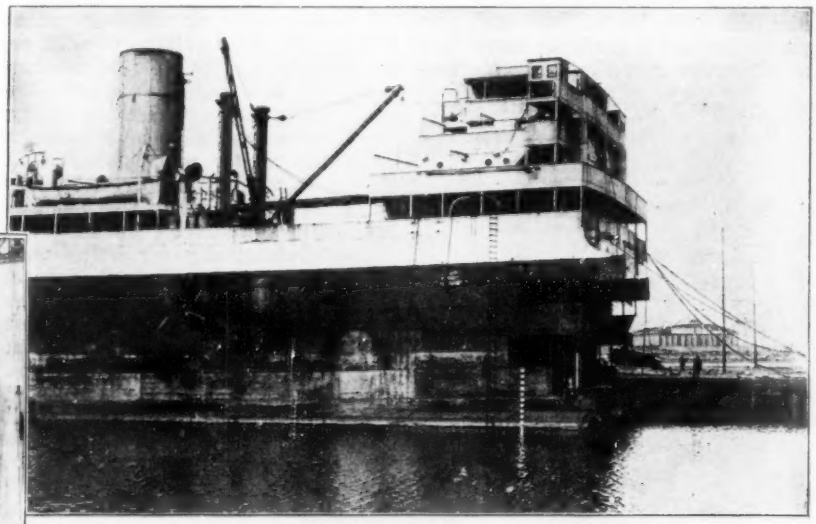
P and A

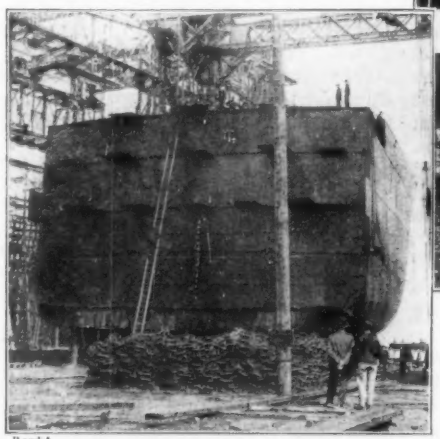
BEGINNING A HUGE GAS TANK

An army of workmen, each manning a jack, placing the foundation, at Norfolk, Virginia, of one of the largest gas tanks ever built. It is 180 feet in diameter and when completed will hold a gas supply of 3,000,000 cubic feet

LAUNCHING HALF A SHIP

Below is shown the new fore-end which was recently launched at Queen's Island, Belfast, Ireland, for the *Lochamonar* which ran ashore last year. In order to prevent her becoming a total loss, about 150 feet of her fore-end was cut away at the time. At right is shown the after part.





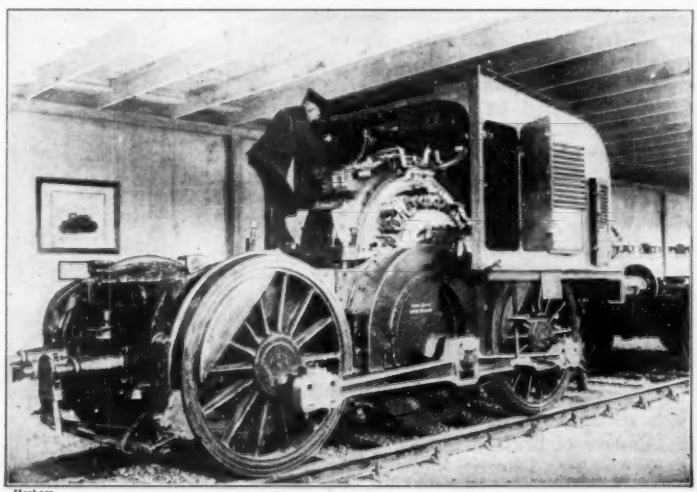
P and A

ELECTRIC SWITCHING ENGINE

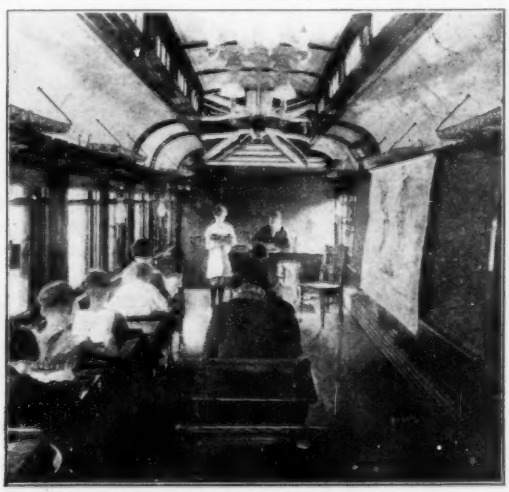
This small but powerful tractor switching engine is used by the German National Railways. It is designed for use on flat lands and can pull heavy loads where grades are slight

RAILROAD CAR SCHOOL

To reach scattered settlements in Canada, the Canadian Pacific Railroad supplied this school car. The teacher travels with the car, which stops a few days or a week at each place



Herbert



There is a Lot to Just Sitting or Standing

Anatomical Studies Show that Man Has Not Yet Become Adapted to the Erect Position. His Everyday Working Efficiency is Governed by His Posture

By DONALD A. LAIRD, Ph.D., Sc.D.
Professor of Psychology and Director of the Psychological Laboratory at Colgate University
Editor, Industrial Psychology

A MANUFACTURER wanted me to size up chairs for him, to help select ones which would eliminate all possible fatigue. I have just finished working through more than 150 hard-to-read scientific reports on posture in an effort to give him the help he wanted—and also partly so that I could sit better and stand better myself. With his permission I am letting you see my report to him.

THE "C" CURVE OF THE SPINE

Man's—and woman's—posture is normally erect but many workers slump, believing it rests them. It fatigues them

I was astonished to find that in order to sit or stand scientifically I had to know something about bears, penguins, babies' spines, and how 65 percent of the geniuses of the world have worked. I also made the great discovery that man is the only animal which spits, and that this is due to his posture!

There is no other animal which persistently walks in the vertical position. Bears walk in this upright position from time to time, and once in a while some birds, such as the penguin, strut around in this position, but man is the only one who sticks to this position through thick and thin.

I would advise my neighbor against training his dog to sit up or walk on his hind legs after all this reading. If using this vertical body position is as hard on the dog as specialists say it has been on man, my neighbor would actually be cruel to his pet.

Man, from this point of view, is an animal built internally for living with his trunk in a horizontal position parallel with the surface of the earth, but perverse habit makes him go against the way Nature intended him to go, and thus he walks upright, with his trunk perpendicular to the surface of the earth.

DR. ALES HRDLICA, the distinguished anthropologist of the Smithsonian Institution, has aroused a great deal of interest during the past few months in his collection of modern instances of boys and girls who have walked around on all fours like little kittens until they were so old that their parents were actually worried in many cases.

These children offer additional evidence that man was designed as an engineering product to go around horizontally, but he preferred to become upright.

There are valves in our veins, for example, which function best when we are in the horizontal posture. If we walked on all fours the appendix would not clog up and precipitate a hospital bill. The colon has to work against gravity in the upright trunk. There is more danger of brain hemorrhage in the vertical position of the trunk, as well as increased susceptibility to varicose veins.

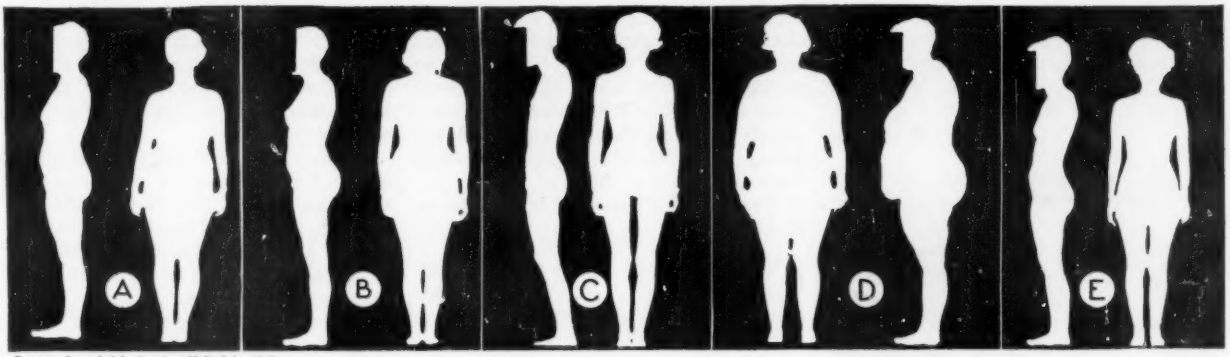
Man has been changed in appearance by his upright position. It has given his spine two curves, so that it resembles an elongated letter "S" while other animals have a spine with a single curve resembling a stretched-out "C."

THE reverse curve we have acquired in our spines makes it easier to balance the trunk on the big femur bones of the leg, by moving the center of gravity of the trunk back a few inches. The year-old child has only the single curve in its spine, but as soon as it begins to walk the additional curve makes its appearance.

Big feet, stronger heels, arches developed, and a larger great toe are the price we have to pay at one end for

THE "S" CURVE—CORRECT

Study of the anatomy of ancient man suggests that modern man's doubly curved spine is a recent acquisition in his evolution



Courtesy Journal of the American Medical Association

SILHOUETTES SHOWING TYPICAL POSTURES MET WITH BY THE FAMILY PHYSICIAN

A shows a fairly good body poise; B is good; C is a typical consumptive chest; D shows displaced internal organs. A typical slouch posture is shown at E. Physicians experience considerable difficulty convincing patients that bad posture is often a cause of bad health

this erect posture. At the other end of the body there have been one or two outstanding advantages resulting from man's typical posture. The range of vision and hearing was enormously increased, while the lower animals still depend almost entirely upon smell and taste. The drainage from the brain is vastly better, due to the upright position of the body. The bony sinuses are drained better, however, in the horizontal position and as a result of walking and sitting upright man has brought on conditions which encourage sinus infections, the most painful infection that can be experienced. Diseases of the ear and mastoid are also aggravated in man.

Within the trunk itself we discover that the upright posture encourages all our mysterious and important "insides" to sag an inch or more, encouraging rupture, displaced kidneys and bladder stones. Great strain is also thrown on the heart, and lung action is restricted, favoring the development of tuberculosis.

My first impulse was to recommend, in view of all these disturbing findings, that work benches be removed and workers told to work on their hands and knees on the floor. It would probably be wiser, however, to help them in order that they may know how to relieve all this strain which man's evolution has placed on them. There seem to be some clear cut and generally accepted principles which can serve as guides, in a field which has been flooded with a great deal of faddist propaganda.

Posture is an *active* thing. It is produced by the co-operation of a great number of simple nerve reflexes —although these are not yet perfectly developed in our present stage of evolution. As a result, posture needs some voluntary help, since nature is not perfectly equipped to take care of it without a little intentional assistance.

POSTURE is a fight against gravity. An exact percentage of good posture can be obtained by measuring one's length while lying down and dividing this by the length when standing up. If one habitually wins the posture fight with gravity he will be as tall standing as he is lying down.

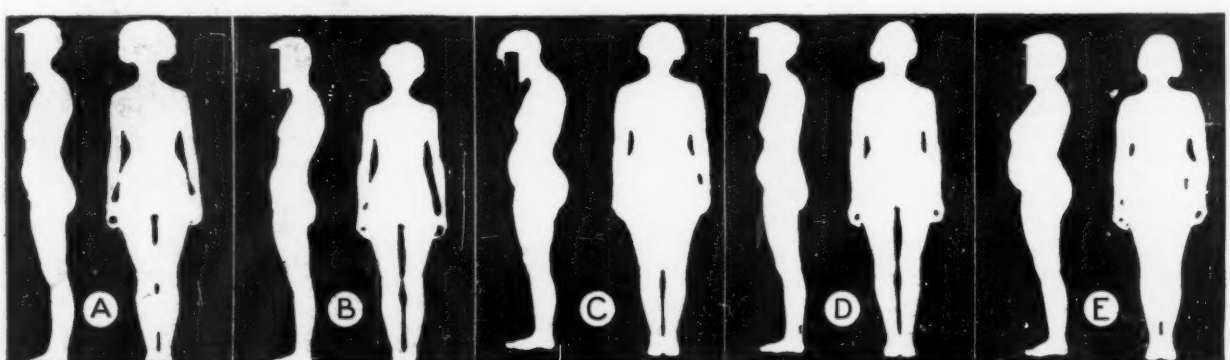
Gravity pulls organs in the body cavity downward. If gravity rather than posture wins the fight the waist measure will be larger than the chest. Chest circumference should be 10 percent greater than that of the belt line.

The curve should be kept in the small of the back. This can be tested readily by standing naturally with back to the wall; if the posture is right the hand should fit snugly between the small of the back and the wall. Tall, slender people should give most attention to posture as their build makes them especially prone to bad posture.

There is the kangaroo type of posture in which the upper part of the trunk is in front of the line of gravity and the legs are behind this line. The gorilla type is just the opposite. In both instances the trunk is not nicely balanced on the center of gravity and there is a constant strain to keep the body from falling forward or backward.

Whether posture is "good" or "bad" there is a continual struggle of muscles to keep the body from succumbing to gravity. This may be such a habitual strain that we are not aware of it. Thus it is doubly insidious. Just standing may become very fatiguing for this reason. So will sitting, unless mechanical support is provided by the chair in order to relieve the strain of the balancing muscles. When standing for a long time is absolutely necessary, the habit should be formed of carrying the body weight on the ball of the foot, rather than on heel or toe, and rests should be taken intermittently by flexing one leg and allowing the other to carry most of the body weight.

In practically all jobs, however,



Courtesy Journal of the American Medical Association

MORE SILHOUETTES, SHOWING SEVERAL TYPES OF POSTURE COMMONLY OBSERVED

A slouches, while the others are familiar to all of us. B is thrusting out the abdomen. C is doubtless a desk worker, the head being bent forward; D has one raised shoulder, but E stands in an erect military posture. Good posture is acquired only by intentional effort

arrangements can be made so that work can be done while either sitting or standing. Changing from the one position to the other is genuinely restful. Even office desks and chairs have been arranged so this can be

Courtesy Journal of the American Medical Association

SILHOUETTE TUNNEL

In obtaining the silhouettes the shadow was projected on an illuminated screen

done. Continuous sitting appears to be as undesirable as continuous standing.

If the sewing or assembly bench is raised about ten inches higher than is customary, and chairs are made with legs correspondingly longer and provided with a foot rest, it is possible for the worker either to sit or stand and save a great deal of fatigue through these changes in his position.

SPECIAL attention should be given to the chairs or stools. They should be of such a height that the sitter's feet can rest on the floor easily and squarely. When a stool is used it should be provided with a real foot rest; the rounds if used as foot rests cause the legs to be drawn back into a cramped and fatiguing position. Since people vary in leg length the height of the chair or foot rest should be easily adjustable.

A fairly serviceable way of telling whether the height of the working surface is about right is to hold the hands palms up, let them swing idly at the side and come to rest about a foot in front of the body. The knuckles should just touch the working surface. There are a very few people with long arms and short body trunk for whom it is almost a mechanical impossibility to sit and work without being in a bad posture.

The seat of the chair or stool should be moulded to fit the natural curves of the body. An ingenious efficiency engineer has recently modeled a chair seat by having all his friends sit in a block of modeling wax so that he soon obtained a composite picture effect to serve as a guide. There is no particular advantage in an upholstered chair seat unless it has deep springs—which office and factory chairs seldom have. A saddle shaped chair is better than one with an inch of upholstery. A ventilated chair seat is also to be desired.

ONE can sit on a soap box and conquer gravity, but only with considerable effort. There should be a specially designed back rest. A rather narrow rest which will fit into the small of the back and bear gently forward is recommended. This is the same effect as when posture is measured by standing with the back to the wall and the hand passed between the wall and the small of the back. The height of this back rest should be adjustable so that the chair will fit both tall and short people. The seat should be narrow enough so that the sitter will be thrown back against this back rest, whether he wants to or not. The narrow width seat will make a gravity-tension-relieving-posture fairly automatic.

To prevent constricting the blood vessels under the knee, the front edge of the seat should be gently rounded. The foot rest also helps to avoid this congestion which will affect nerve as well as blood supply in a poorly designed chair and produce the effect of putting one's leg to sleep.

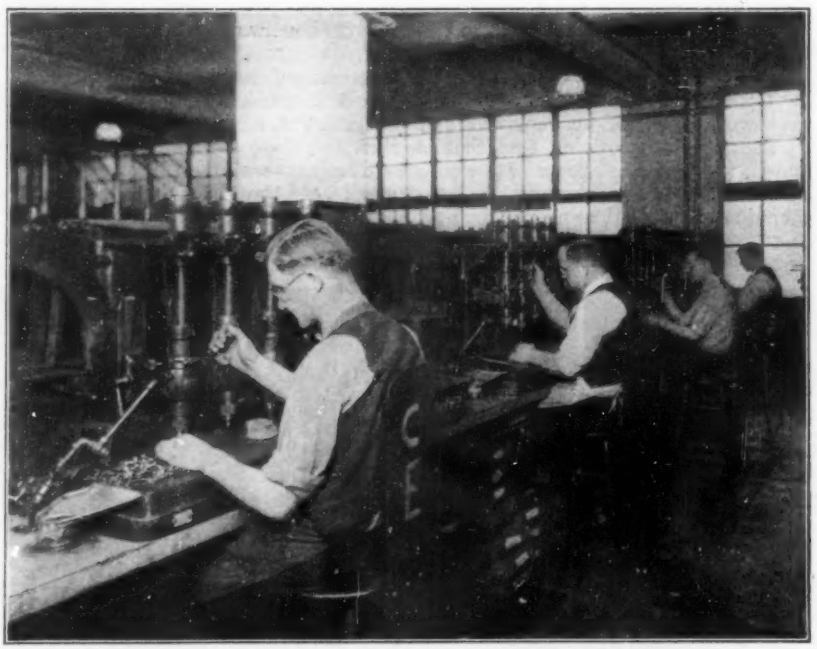
Attention to posture will not cure all the ills of man; the tensed machine-like posture of the West Pointer is beautiful to watch but may be carrying the idea to extremes for the sake of military aims. But since man is built essentially as a horizontal animal, special attention is desirable for his fatigueless and efficient working in the vertical plane.

William James, the first psychologist at Harvard, observed 30 years ago that there is a redundant effect in posture, the firmly erect posture keeping up spirits, and making it difficult to entertain fears, despondency, and depressing thoughts.

Modern psychological investigation is confirming Professor James' keen observation, and a possible explanation of the why of this redundant effect is emerging. The great physiological background for our emotional lives seems to arise from the vaguely perceived internal sensations caused by visceral tensions. We are never directly aware of these visceral sensations—even a stomach ache does not come from where we feel the pain. We react unconsciously to many of these internal sensations by ups and downs in mood.

DRUGS or disease may alter the normal tension balance of the internal organs, and the emotional changes these bring about are a matter of everyday observation. Now it is becoming apparent how posture may also change the balance of the internal organs, and with these visceral tensions minor emotional ailments may be started.

Human beings are not born with good posture made natural for them. While it is not original nature to have correct posture, it can be made second nature by training in good posture habits.



FACTORY WORK IS SLOWED DOWN BY BAD POSTURE

Here are factory stools which have been fitted with home-made back rests, but none of the workers are using them properly, all the workers' backs having a "C" curve. Also there are no foot rests

It Reknits Hosiery

Run-Repairer Is Worth Millions

A GASP of dismay bursts from the lips of the wife. The husband looks up startled. Only some extraordinary catastrophe could call forth such a devastating outburst from the little woman who usually is so placid, refined and self-possessed. She continues.

"Look at that stocking! Hopelessly ruined! Just bought today. Six dollars for the pair and now I catch them on a splinter on that chair I've asked you again and again to fix. Why doesn't somebody invent a machine to repair the runs in stockings?"

That speech was made at least sixty million times in the United States last year. With stockings becoming more and more sheer, and skirts shorter and shorter, runs have been taking on an ever-increasing importance.

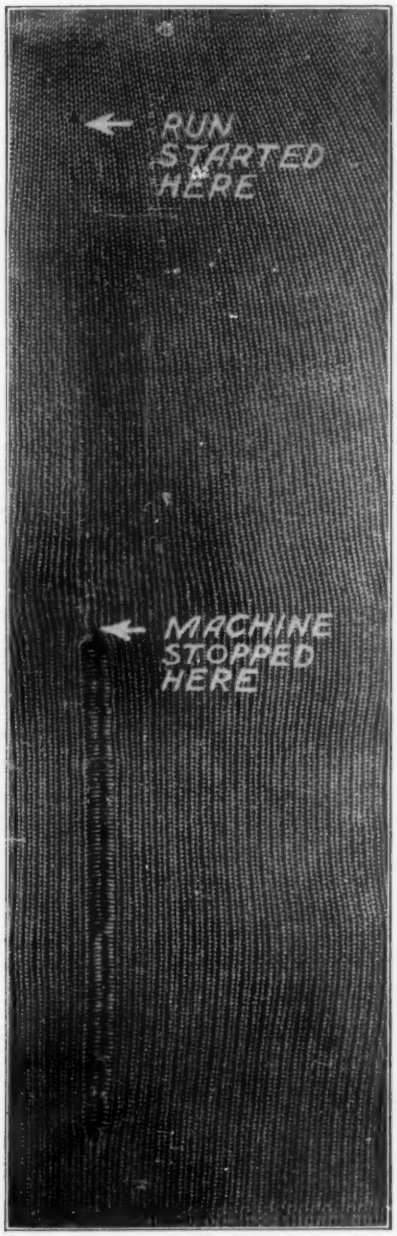
SUCH is the situation which influenced two brothers to refuse a million dollars each for the patent rights to an electric machine which they have invented to repair the broken stitches in silk hosiery. Instead they have accepted a substantial number of shares in a new corporation to be organized by the Gotham Company for the sole purpose of repairing runs. The value placed on the invention, upon which six patents are pending, is between 15,000,000 and 20,000,000 dollars.

Repairing the ladder-like runs in stockings is fascinating. A latch needle is used; this is a hook-like device, which by proper movement is converted automatically into an eye, offering no sharp hooks or points to tear out or unravel additional stitches.

With the new Knitbac machine it is all done electrically. You insert the needle in the last perfect loop of the broken thread. This loop hangs on the needle's shank, the thread to be looped being placed in the hook. As the needle descends, the loop on the shank comes up and forces the latch closed, making an eye. It then folds down until the thread caught in the hook is pulled through the fabric. As the needle rises again, the hook opens and the process is continued until the original thread is looped back into the fabric. When next the stocking is worn, the most critical observer will fail to see that it ever has been repaired.

LIKE LIGHTNING FINGERS

Swiftly the machine opens and closes, pulling the thread through until its task is done



BEFORE AND AFTER

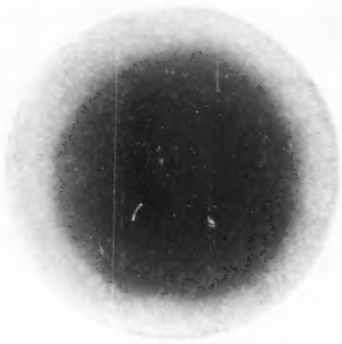
Reweaving the stocking wipes out completely all trace of the ugly ladder-like run

THE OLD WAY AND THE NEW

The young woman on the left can repair runs by hand as effectively as can her companion with the newly developed machine, but it takes her twelve times as long to accomplish the task

Lest the stocking should slip when being repaired, a toothed gauge holds it firmly in place. Should a mistake be made an automatic brake stops the operation. It is said that by the use of the machine, runs in stockings may be repaired ten or twelve times as rapidly as by the old hand method.

Samuel and William Leavin are the inventors. As proprietors of a little shop selling novelty hosiery, they worked out an idea for a machine, convinced the Gotham Company of its value, and were financed for five years while they perfected their device.



A WAVE ATOM

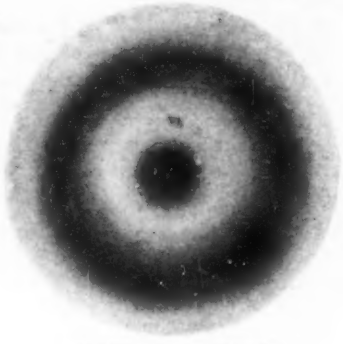
An attempt to depict the concept of the variation in electric density in a sphere. At instant chosen it is greatest at the center

Wave Atoms*

A Scientist Explains Further the Inwardness of the New Schrödinger Atom Concept

By PAUL R. HEYL, Ph.D.

Physicist, United States Bureau of Standards
Corresponding Editor, SCIENTIFIC AMERICAN



ANOTHER CONCEPT

We might assume that the vibration within the Schrödinger atom was broken up into segments, for example, like the one shown

"I'VE come back, you see," said the visitor.

"Yes, I remember you," said the scientist. "You came here some time ago, asking me to show you an atom—which I could not do."[1]

"But you did show me something worth seeing, and in so doing you started something; you set me thinking."

[1] SCIENTIFIC AMERICAN, July, 1928

The New Atom

IN a previous article which was widely quoted and commented on by other journals, the author, Dr. Heyl, told us how scientific styles in atom concepts changed from time to time as new experimental evidence forced their revision. Science is never a settled thing. It is in a state of constant flux. It evolves. When science becomes finally "conclusive," fixed and settled; when scientists at last "know it all"—then science will be dead.

The new atom concept of de Broglie and Schrödinger—better known among physicists as the new wave mechanics—is still an infant of three. More will be heard of it when it is a little older. As Dr. Heyl says, even the professional physicist is still a bit vague about it—still going to school on it. Perhaps something like the following will happen: the new atom will reach the newspaper and general public stage of discussion in a year or two. Before then, readers of the SCIENTIFIC AMERICAN will no doubt wish to acquire a working knowledge of it. The available literature, excepting that suited only to the real 32nd-degree "math. shark" and physicist, is not large. A semi-popular paper by Dr. C. J. Davisson of the Bell Telephone Laboratories in New York, entitled "Are Electrons Waves?", appeared in the May, 1928, issue of the *Journal of the Franklin Institute* (Philadelphia); another semi-popular paper by Dr. Paul R. Heyl, in *Scientific Monthly* (New York) January 1928. Also see *Physical Review*, December, 1927. —*The Editor.*

"That I would not willingly stop," replied the scientist, smiling. "But what brings you back today?"

"Well," said the visitor, "You spoke of the very latest mode in atomic fashions—the Schrödinger wave atom; and the more I think about it the less I understand it. To begin with, a wave presupposes something which undulates. What is it that undulates in the atom?"

"I can't exactly say," replied the scientist.

The visitor grinned.

"You play a good defensive game," said he. "I expected you to say 'electricity,' and then I was going to corner you and ask 'what is electricity?' But you perhaps see my difficulty," continued he. "The whole thing has impressed me as a piece of pure speculation, and rather a hazy one at that. Is not that all that it is?"

"That is all that it was at first—pure speculation."

"And what is it now?"

"We may regard it at least as a lucky guess, if nothing more, for there has recently been brought forward a piece of experimental evidence which indicates that atoms (or rather, electrons shot out from atoms) are of a wave-like nature."

"Really?" said the visitor. "That alters the state of things. I see you can attack as well as defend. You have hit my weak spot. I may be called credulous, even gullible, but I am ready to accept anything on experimental evidence—if there is no simpler explanation."

The scientist nodded approvingly.

"That is the right scientific attitude—the simplest explanation that fits the facts of experiment. Only sometimes the simplest explanation is rather complicated."

"Tell me more about this," said the visitor. "How is one to know whether an atom—a thing which no one has ever seen—is really a little bunch of waves or a tiny particle of—of something or other? What is the line of attack to follow in such a case?"

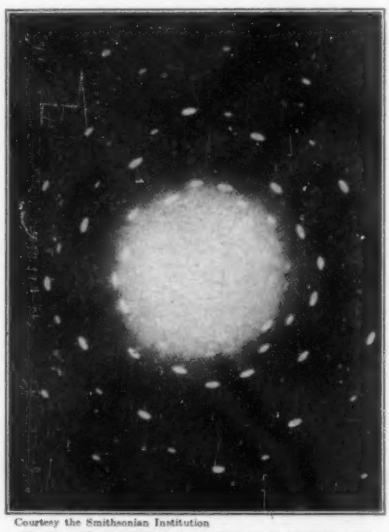
"In general outline, much the same as you yourself would follow in attempting to form an estimate of the character of a stranger. You would judge him by his actions. So we judge the nature of an atom. If, under conditions where the behavior of waves and of particles are quite different, an atom acts in a wave-like manner, we form our judgment accordingly."

"And anyone would say that you were drawing the only possible conclusion. But go on, please; tell me more. What are the particular conditions that enable one to discriminate between waves and particles?"

"For one thing, reflection from a smooth surface."

The visitor thought for a moment.

"Do not waves and particles act pretty much alike on reflection? I know that a beam of light waves is reflected from a mirror at the same angle by which it approached it; and is not the same true of the rebound of elastic balls? I cannot think at the moment of any difference in the be-



Courtesy the Smithsonian Institution

X-RAY DIFFRACTION PATTERN

X rays falling on a crystal of magnesium oxide are reflected at uniform angles

*Publication approved by the director of the Bureau of Standards of the U. S. Department of Commerce.

havior of light waves or particles on reflection."

"Perhaps not," said the scientist. "I was referring not to light waves but to X rays. Their behavior on reflection may be quite different from that of light waves—or of particles."

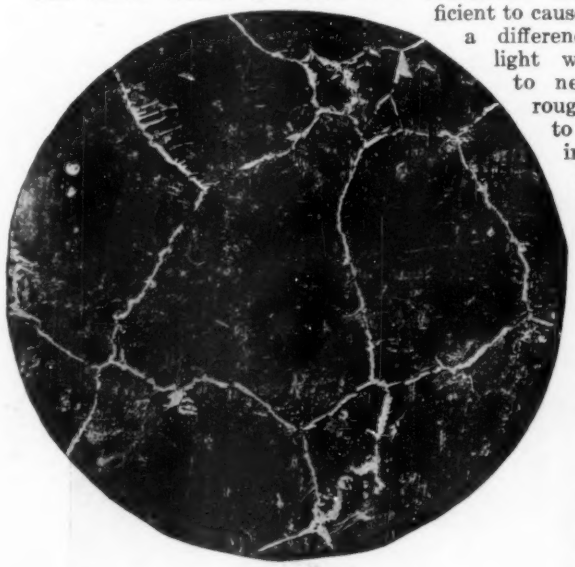
"THAT is something with which I am not familiar," said the visitor. "Of course, I know that X rays are now recognized as waves, something like light, but much shorter in wavelength—10,000 times smaller, aren't they?"

"Something like that. But a little acquaintance with the laws of reflection of X rays is necessary in order to understand the force of the newly discovered evidence for the wave-like nature of the atom. And it is rather a long story."

"Go on, please," said the visitor. "You have started something again; you have aroused my curiosity."

"Well, to begin with," said the scientist, "the nature of the mirror that reflects X rays has much to do with the way in which they are reflected." He picked up a small polished slab of metal from his desk. "Here is a piece of steel which has had one of its faces (the top) etched by acid. Notice the difference between the top and bottom faces."

The visitor turned the block over in his hand. Its lower face was smoothly polished; its upper face was equally smooth to the touch, but was covered by a mosaic of little patches, roughly geometrical in shape, some brighter and some darker than others.



ALSO ETCHED

The same steel was heat treated at 1100°, Centigrade, and cooled. Magnification 250 diameters. Note increased size of crystals

"Use this glass to look at it," said the scientist. "Steel, or in fact any metal, is made up of a mass of closely packed crystals, small and large. This structure is not apparent on the polished face, but can be brought out by etching with acid. A beam of light reflected from such a metallic surface behaves in the same way as it would if the surface had been that of water or any other reflecting material; but a beam of X rays reflected from this slab of metal would be scattered in all directions."

"That is strange," said the visitor. "What is the cause of it?"

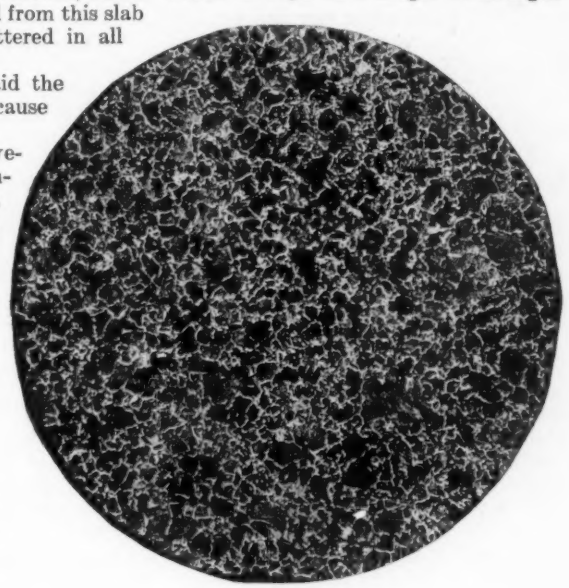
"Difference in wavelength, principally," answered the scientist. "Light waves are many times greater in wavelength than X rays, which are comparable in size to atomic dimensions.

"THE difference is something like that between a man and an ant. To a man, a smooth sandy beach is a flat surface, a suitable place for establishing speed records. To an ant it is a rough and stony desert. Such extreme conditions are sufficient to cause quite a difference in behavior. The light waves are big enough to neglect the molecular roughness of a surface, and to behave after reflection in a dignified and geometrical manner, while the tiny X rays encountering the same obstacles are put to confusion.

"And we must also consider the fact that the X rays can penetrate metals and opaque bodies to a considerable depth. This exposes them the more to the disturbing influence of molecular structure. But curiously enough," went on the scientist, "if we confine the incident beam of X rays to the face of a single crystal, like this one," (and he pointed out on the etched surface a bright area nearly a quarter of an inch square) "the rays are then regularly reflected instead of being scattered in all directions."

"But," said the visitor, "how does that square with what you have just said about scattering being due to difference of size of the waves?"

"Regularly reflected," continued the scientist, "but not after the manner of light waves. When a ray of light of a single color (that is, of a single wavelength) falls upon a mirror it is always reflected in some direction, no matter what the angle of incidence may be; but if X rays of a single wavelength strike a crystalline face there will be little or no reflection unless the angle of incidence is just right."



ETCHED STEEL

A piece of 0.5 percent carbon steel heated for six hours at 850°, Centigrade, and air cooled. Magnified 250 diameters

"There is nothing like that in light waves," said the visitor, thoughtfully. "What determines whether the angle of incidence is 'just right'?"

"The nature of the crystal and the wavelength of the X rays. It is as if a mirror of silver would reflect red light only at an incident angle of 40° and green light only at 60°, while a mirror of brass would reflect the same rays only at angles of 30° and 50° respectively."

"THAT is something I cannot understand," said the visitor. "It is recognized—is it not?—that X rays and light waves differ only in degree—that is, in wavelength? But their behavior after reflection seems to differ in kind."

"That is rather hard to understand, I admit; but we must remember that it is this difference in degree of wavelength that is one factor in permitting X rays to penetrate metals, thereby bringing about a different kind of environment from that of the light waves, which scarcely penetrate the surface in being reflected, and can hardly be said to have time to find out what the reflector is made of."

"I see," said the visitor. "The light wave keeps to the surface, like a rebounding ball; the X ray gets some

distance below the surface before it is turned back."

"Exactly," said the scientist. "Although there may be little difference in the behavior of reflected light waves and rebounding particles, there is no possibility of confusing particles with X rays."

"I can guess what you are coming to," said the visitor. "Electrons behave like X rays."

The scientist smiled and nodded.

"YOU are a good guesser. That is what Davisson and Germer have recently discovered." [2]

"But electrons have been known for many years, and there must have been a great number of experiments carried out which involved their reflection. How did it happen that this peculiar behavior has only just been noticed?"

"By accident. Many such experiments have indeed been made, but naturally on pieces of ordinary metal like this," and he pointed to the etched slab of steel. "From such a reflector made up of many small crystals, electrons are scattered in all directions. And this is just what Davisson and Germer were doing when they made their accidental discovery. They were studying the distribution of the electrons rebounding from a target of nickel. The whole apparatus, of course, was enclosed in an evacuated glass bulb. It happened that the glass broke and the inrushing air coated the hot target with a film of oxide. To clean it from this tarnish it was heated for some time in hydrogen. After setting up the apparatus again in a new bulb, the experimenters were surprised to find that the reflection of the electrons from the cleaned target had become regular."

"And the only difference was the heat treatment that the target had suffered in the mean time?"

"That was all."

"What did that do?"

"Metallurgists have long known that by suitable heating, straining or annealing of a metal, the crystals of which it is built up can be considerably increased in size. Examination of the nickel target showed that this is what had happened. During the prolonged heating involved in the cleaning process, the crystals of nickel had grown so large that it was almost a case of reflecting the electrons from a single crystal instead of from many. This greatly altered the distribution of the reflected electrons.

"WHEN this fact became clear, the key to the situation was in the hands of the experimenters. They produced as large a crystal of nickel as they could, and studied the behavior of electrons reflected from it. In every particular the reflected electrons behaved in a manner similar to that of X rays."

"Do you mean to say," asked the visitor, "that the angle of incidence has to be just right before an electron can be reflected?"

"Approximately speaking, yes."

"But what determines that angle?"

"It appears that the speed of the electron has much to do with it. The speed seems in some way to correspond to the wavelength of X rays under similar circumstances. The greater the speed the shorter the corresponding wavelength. If an electron is a particle this is incomprehensible; but if it is a little bunch of waves it is much easier to understand. We have only to suppose that the waves of which it is made up travel with speeds which depend on their wavelength, the longer waves traveling more slowly than the short ones."

"Are there any known waves that do that?" asked the visitor.

"YES and no," answered the scientist. "There are plenty of cases, such as light waves in glass, or deep-water waves; but the difference is that they do it the other way about. Their long waves travel the faster. And in free space (to which the interior of an evacuated tube is a good approximation) all waves of light travel with the same speed."

"Then if electrons — and atoms— are waves, they must be of a different nature from light waves?"

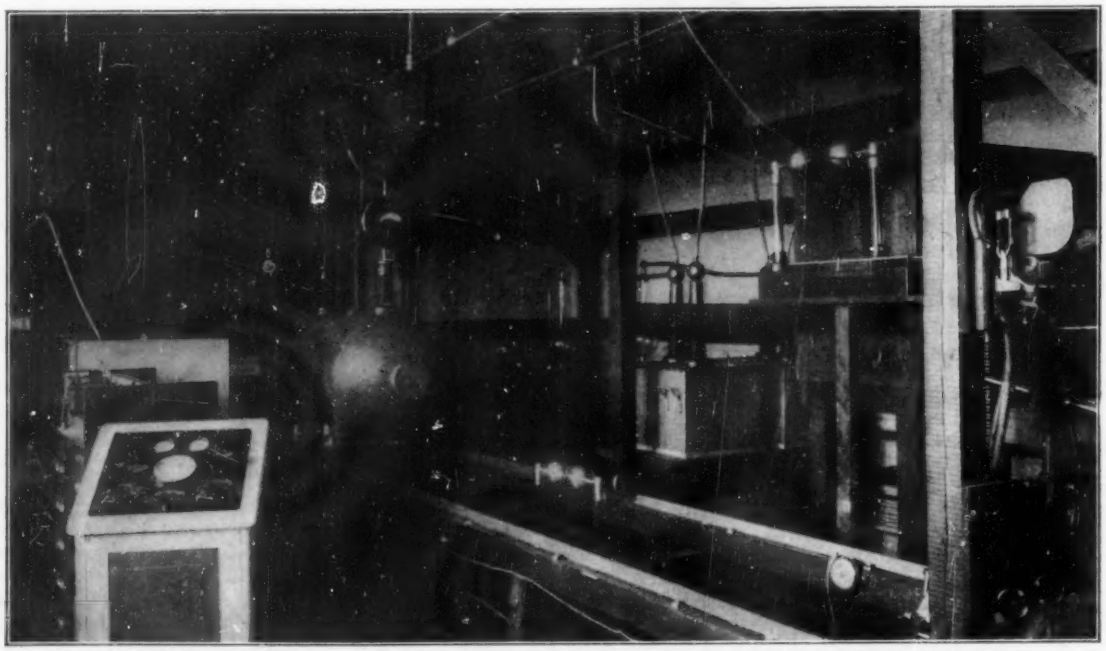
"Either that, or they must be carried by a different medium."

A slow smile spread over the visitor's face.

"I see," said he, "that you had your wits about you when I asked you what was vibrating in the atom. You did not say it was the ether."

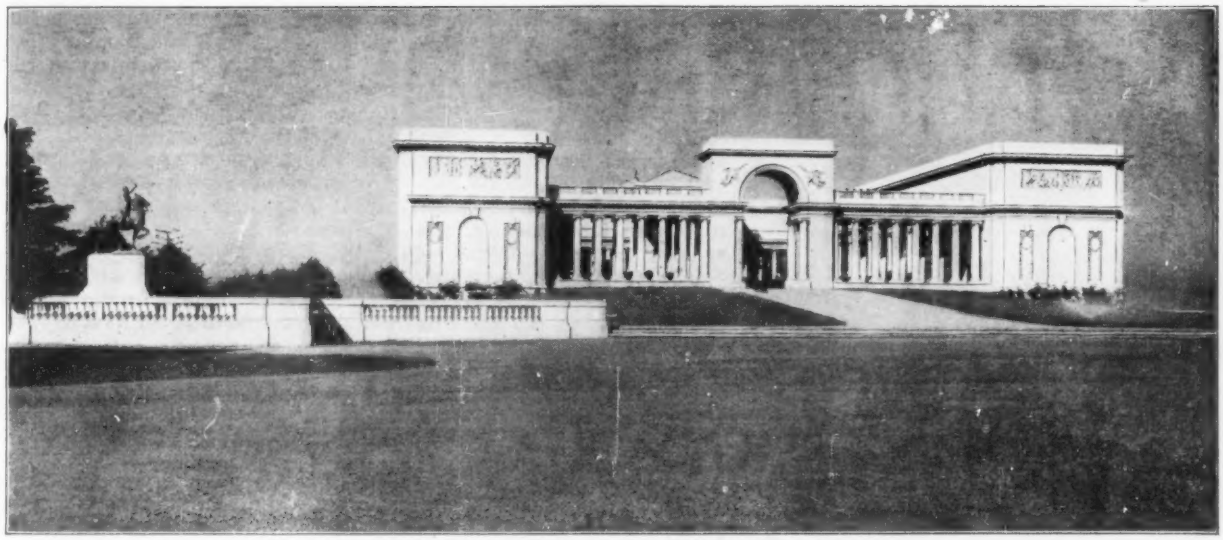
"No," said the scientist, smiling in return. "I did not feel warranted in saying that. We do not know much about that aspect of the subject. All we feel reasonably certain of is that an atom behaves more like a wave than a particle."

[2] *Physical Review*, December, 1927; *Journal of the Franklin Institute*;, May, 1928.



A GENERAL VIEW OF THE X-RAY LABORATORY AT THE BUREAU OF STANDARDS

With such apparatus the behavior of X rays has been determined. For advanced technical accounts, see Philosophical Magazine, *47 (1924), page 446—the first mention of the new concept; also* Annales de Physique, *3, (1925) page 22 and* Physical Review, *December, 1927*



THE CROWNING GLORY OF A SAN FRANCISCO HILL

Dedicated to the memory of California soldiers who fell during the war, and to the great purpose of advancing the knowledge of art and kindred subjects, the California Palace of the Legion of Honor surmounts a hill where it may be seen from all parts of the city and from the harbor

San Francisco's Memorial Museum

A Gift to the California City, This Magnificent Building Is a Replica of the Palace of the Legion of Honor

By CHARLES W. GEIGER and RUTH SABICHI

ON the summit of the highest hill in San Francisco, overlooking the Pacific Ocean and the world-famous Golden Gate, the magnificent California Palace of the Legion of Honor stands as a memorial to the California soldiers who fell in the World War.

This 2,000,000 dollar memorial, a replica of the Palace of the Legion of Honor on the banks of the Seine in Paris, was presented to the city of San Francisco by the late Adolph B. Spreckels and his wife, Alma de Bretteville Spreckels. It is intended first of all to honor the dead while serving the living; secondly, to establish and maintain in the city of San Francisco a museum and library of art; thirdly, to encourage and develop the study of the fine arts and the application of the arts to manufactures and practical life; and fourthly, to advance the general knowledge of kindred subjects, and to that end to furnish popular instruction.

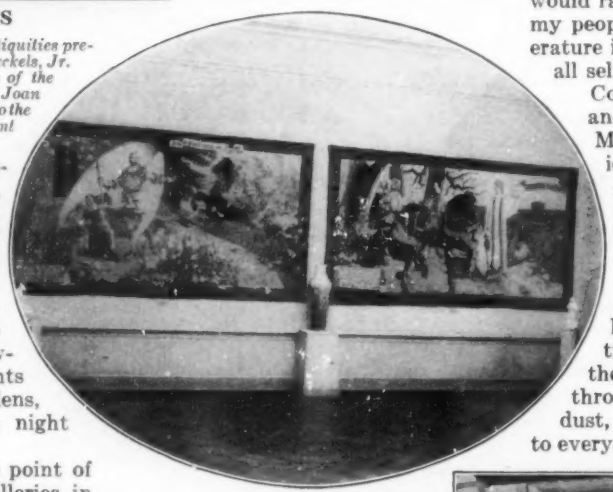
THE California Palace of the Legion of Honor is expected to become a great educational center because of its art galleries, little theater, and specially designed organ.

The setting of this great palace-museum is most commanding and beautiful. There are few monuments in history which have had sites equal to this. Erected on ground given by the municipality of San Francisco, it stands in the magnificent frame of Lincoln Park and its beauty can be seen not only from all parts of the city, but from far out at sea. Far below on one side, lies the blue water of the Pacific. In the middle distance can be seen the Golden Gate, and to the right San Francisco, shimmering in the sunlight, has the appearance of an Italian or a Spanish city. The building is surrounded by terraced gardens from which visitors may view the Pacific Ocean, the Golden Gate with steamers and sailing vessels from all ports of the world passing in and out, Mile Rock Lighthouse, stately Mt. Tamalpais across the bay, and the San Francisco harbor, the largest land-locked harbor in the world. Sunset from these terraced gardens is a sight long to be remembered. As the sun sinks into the horizon at sunset, the Golden Gate becomes truly one of gold.

IN THE GOTHIC PALM COURT

The "Smiling Angel of Rheims" stands here surrounded by a great variety of semi-tropical plants, by seats, and promenades

THE style of the California Palace of the Legion of Honor is French Renaissance of the period of Louis XVI, a style which lends itself well to the quiet, dignified treatment necessary for museums. Approaching the building, one's attention is attracted by the imposing statue of Jeanne d'Arc by Anna Hyatt Huntington, which is said to be the finest statue of the French martyr ever made. Behind the Triumphal Arch, which is surrounded by colonnades and which constitutes the entrance to the palace, extends the spacious Court of Honor, sur-



TWO FINE EXHIBITS

Above is shown a group of Egyptian antiquities presented to the museum by Adolph B. Spreckels, Jr. At the right may be seen two panels of the Gobelin tapestries depicting the life of Joan of Arc, a series of which was presented to the great museum by the French government

rounded by Ionic columns prolonging those of the façade. In the center of the Court of Honor is Rodin's famous statue, "The Thinker." The Triumphal Arch, the surrounding colonnades, and the front wings of the Palace are flood-lighted at night by powerful batteries of flood-lights placed in the terraced gardens, presenting a most inspiring night scene.

The marble rotunda is the point of departure of the 19 long galleries in which are exhibited paintings, sculptures, engravings, prints, tapestries, and other works of art.

IN the center of the rotunda is the "Age of Bronze" by Rodin. There are two palm courts where antique fountains are playing, and semi-tropical plants and flowers abound. There are also attractive seats where visitors may rest after making the circuit of the galleries. One of the palm courts, known as the Gothic court, is ornamented with a doorway of the Church of Toul, and the Smiling Angel of Rheims, while the Indo-China court is ornamented with the low relief of the Temple of Ankhor Wat.

One of the most popular features of the Palace of the Legion of Honor are the organ recitals given by Mr. Uda Waldrop on the pipe organ costing 150,000 dollars, which was the gift of John D. Spreckels. The main instrument is over the vestibule at the building's entrance and the echo organ is placed at the opposite end of the building in the "Tapestry Court."

In the Triumphal Arch in front of the Court of Honor is installed a full set of chimes and also a fanfare of trumpets to announce the theme of the concert. These may be heard for several miles over the city and out at sea. The whole organ may be played either to the interior of the building or out into the Court of Honor and surrounding parks. There is an immense frieze over the entrance to the building representing "The Sacrifice." When the organ is to be played out into the Court of Honor, this frieze is raised by electric motor, thus permitting the organ to be heard clearly outside the palace. There are also special connections for the organ console in the Court of Honor permitting the console to be played from this point. The dome of the rotunda as well as the echo-organ dome is covered with airplane cloth so that the organ recitals may be heard clearly in every gallery.

On the terrace floor are the offices, library, tea-room, studios, and theater. The theater seats 250 persons and has a complete stage including the most modern electrical equipment. The ceiling has been decorated by Señor Jose Vilay Prades and represents Inspiration on the Wings of Pegasus surrounded by seven arts. The center design is the symbolic figure of a dead warrior. In this theater, lectures, concerts, moving pictures, and plays can be given.

A projection room, fully equipped with the latest moving picture apparatus, serves to further the educational work of the institution. The French government has generously given the museum 500 slides and a number of valuable books of the monuments, cathedrals, chateaux, et cetera, of France, to assist in this work.

Among the notable exhibits in this great palace-museum, the following may be listed as representative: a series of Gobelin tapestries depicting the life of Jeanne d'Arc—after the drawings of the painter Jean-Paul Laurens—and an important collection of about a hundred works of art from the National Sevres factory, all having been presented to the museum by the French government.

AUGUSTE RODIN is represented by a group of 32 pieces collected by Mrs. Spreckels, among which are "The Thinker," mentioned above, and "Saint John the Baptist." Mrs. Spreckels has lent her valuable collection of art objects to the museum. "I would rather have the knowledge that my people can enjoy the art and literature in the museum than to keep it all selfishly for myself," she said.

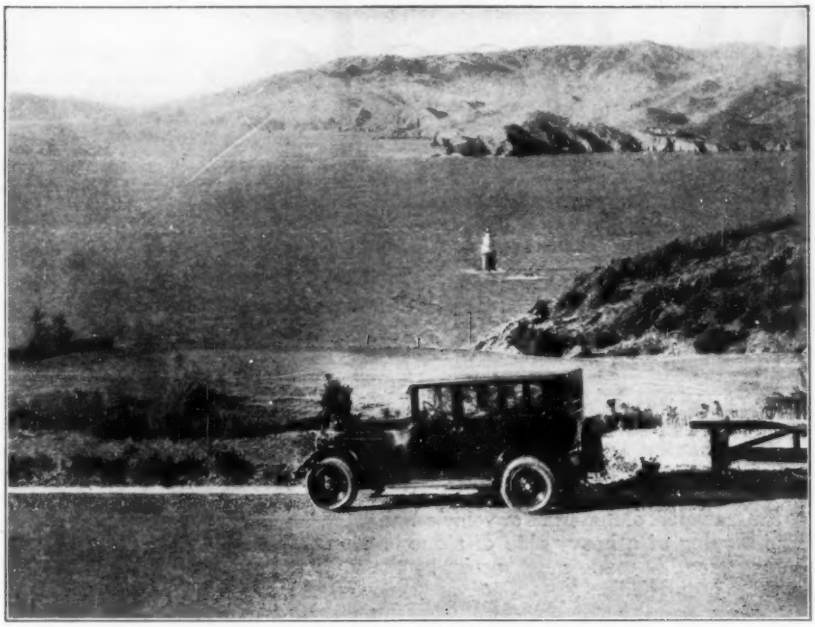
Constructed of concrete, stone, and steel, under the direction of M. Guillaume, aided by the American architect, Mr. George A. Applegarth, the museum is equipped with a perfect lighting system permitting of visits both day and night. The day lighting is brought in at an ideal angle for the various exhibits, and the night illumination is at the same angle. All of the air for the building is washed through a water screen to remove dust, and is then heated and carried to every part of the museum. An even

A QUEEN'S GIFT

The Queen of Greece presented this beautiful collection of Greek vases to the new memorial museum

temperature is maintained the year around, without visible radiators in any of the galleries.

While planning the building, inspections were made of many American museums and a careful study made of the plans of all European museums of importance. Built according to facts brought out by this study and exhaustive research on new problems, this edifice marks an advance in museum design and construction. Most of the European museums have been old palaces and civic buildings, while in America each museum has been a new creation carefully studied for the purpose of perfecting it in every detail of plan and equipment. Consequently, in America the improvement in this type of building has been very rapid in the last 25 years. It may be said in all truth that the California Palace of the Legion of Honor is the very last word in museum construction.



THE GOLDEN GATE FAR BELOW

Mile Rock Lighthouse, the immense hills across the bay, and the entrance to the harbor of San Francisco—called the Golden Gate—may be seen from the highway leading up to the museum

THE history of this palace-museum idea and of its realization, setting forth more forcibly than by any language the faithful friendship existing between two great republics, France and America, is worth relating. Its conception dates back to the Panama-Pacific International Exposition which was held at San Francisco in 1915. The French government had been invited before the war to exhibit there. Notwithstanding the fact that many difficulties had arisen due to the beginning of the war in Europe, France, upon the urgent entreaty of M. Tirman, Councillor of State—who had been appointed as Commissioner General for the French Government at the exposition—decided to be represented there.

In two months, with the aid of the architect, Henri Guillaume, M. Tirman succeeded in causing to rise from the ground the French Pavilion, constructed of temporary material, a faithful reproduction of the Palace of the Legion of Honor. This effort of a country engaged in war, met with great acclaim, the more so that the various exhibits, instead of being scattered among different stands, had been grouped in the pavilion. These exhibits included numerous treasures borrowed from French museums and hundreds of specimens of the products of her principal industries.

It was at that time that two generous Californians who always cherished a love for France, Mr. Adolph Spreckels and his wife, Mrs. Alma de Bretteville Spreckels, conceived the project of erecting a permanent French Pavilion which should be used as a museum of art and culture. This project was interrupted by the entry of the United States into the World War, but was again entertained at the end of hostilities. Work was begun and the great building rose under the direction of the French and American architects but Mr. Spreckels did not live to see his dream come true.

Now completed, this magnificent edifice is dedicated to the memory of California soldiers who fell in battle during the war. It is a touching gesture of French-American fraternity.

THE COURT OF HONOR

Auguste Rodin's famous "The Thinker" surmounts a pedestal in this court which is enclosed by an Ionic colonnade. Batteries of powerful floodlights render this an inspiring scene at night

THE palace-museum is free to the public every day, including Sundays and holidays. It is governed by a board of trustees of which Mr. Herbert Fleishhacker is President, and is maintained by the city and county of San Francisco. Since its opening it has been under the personal direction of Dr. Cornelia B. S. Quinton, Director, and Major W. W. Quinton, Curator.

The California Palace of the Legion of Honor, uniting the memory of common struggles to the peaceful aspirations of the present, will remain, according to M. Jusserand, French Ambassador at Washington, "the testimonial of the sentiments which have always united France and the United States in the days of calm as well as in the days of tempest."

Wheels

By P. CORMAC
F. R. C. Sc. I., M. R. I. A.
University College Dublin

The First of a Series of Articles on the Mechanics of Wheels in Vehicle Suspension, Propulsion, and Steering, and the Gyrostatics of Wheel Wobble

THE wheel, without doubt, is the greatest invention in mechanical engineering. Its primary function is to substitute rolling resistance for sliding resistance in the transport of materials or vehicles. The moving of a heavy slab of stone across a road is made much easier by placing it on rollers.

To move an automobile weighing 3000 pounds along a level concrete road takes a pull of about 45 pounds, corresponding to 2.4 horsepower at 20 miles an hour; the car will coast or "freewheel" down a 1½ percent grade. Without wheels, the vehicle would take a pull of 1500 pounds, corresponding to 80 horsepower at 20 miles per hour; the machine will not coast unless it be on a 50 percent grade.

The remarkable saving in power, arising from the use of wheels, is a direct consequence of the fact that the wheel brings the ground reaction to a

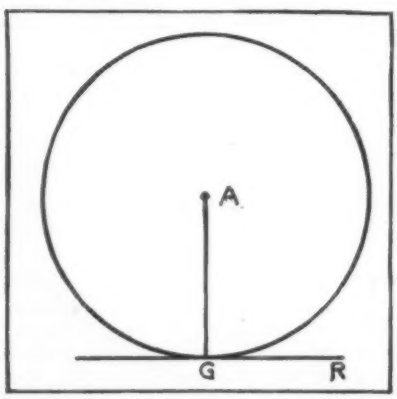


FIGURE 1

The wheel is used to make the ground reaction force at point G *vertical to the ground,* R

direction in which it is powerless to oppose the motion of the vehicle; that is to say, the wheel brings the ground reaction normal or perpendicular to the road surface. The force of the ground on the car, however great, can then have no component in a horizontal direction, and it is only such forces as have a horizontal component or effect that can offer any resistance to the progress of a vehicle.

Taking say the front wheel of an automobile, we have the load of the car applied to the wheel by the stub axle at *A*, Figure 1; the other force acting on the wheel is the reaction of the ground at the point of contact G. The equilibrium of the wheel, under the action of these two forces, requires that the direction of the forces be along the line between the points of application, that is, along the line *GA*. Hence the road reaction acts along the radius of the wheel, and, in consequence, at right angles to the road surface. It can therefore offer no opposition to the progress of the car.

WHAT might be called the First Law of the wheel, that wheels should be kept round, and tires fully inflated, thus follows from Euclid's theorem on the perpendicularity of the tangent and radius of a circle: "The straight line drawn at right angles to the diameter of a circle through its extremity is a tangent to the circle."

In practice, however, we get a slight resistance to motion, even with the best make of wheel. This resistance arises mainly from the fact that neither the axle nor the ground contact are geometrical points. The wheel does not touch the ground in a single point but rather over an area, which, with balloon tires, may be from 10 to 20 square inches. The imperfect flexibility of the tire then gives a couple opposing the rotation of the wheel which when compounded with the supporting pressure of the road on the tire, gives the effective center of contact some .2 to .3 inches ahead of the geometrical center, point *G*, Figure 1.

Again, the axle touches the wheel at a point to the rear of the center as illustrated in Figure 2. The looseness between the wheel and spindle in the figure is exaggerated to show the effect more clearly. The rotation of the wheel carries, as it were, the spindle around with it until a stage is reached when the spindle slips down continuously on the inclined surface at *F*. The greater the friction between the spindle and wheel, the farther will *F* be pulled round from *A*. The line joining *GF* gives the direction of the ground reaction. Plainly this inclined reaction has a horizontal effect or component opposing the motion of the car.

The fact that the axle touches the wheel bearing to the rear of the center is not generally known. It may be

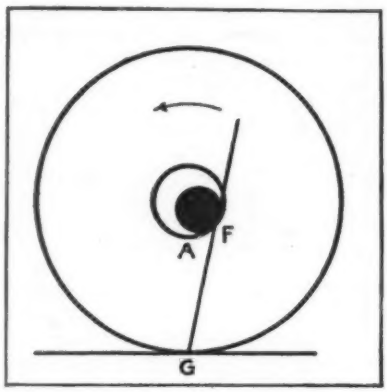


FIGURE 2

The point of contact, F, *between the axle and the wheel bearing is to the rear of center*

verified readily by experimenting with a six-inch wooden disk which has an inch hole bored out at the center. If a pencil be passed through the hole and pressed downward and forward, causing the disk to roll along a table, the pencil will be found touching the disk to the rear of the center line as indicated in Figure 2. Again if the axle of a farm wagon be examined, it will be found worn remarkably on the underneath to the rear.

For driving tires, the ground exerts a forward force and a forward couple so that the effective center of tire contact is to the rear. Axle and wheel contact are to the rear as in the case of front wheels.

The effect of increasing the size of a wheel is to insure that the ground

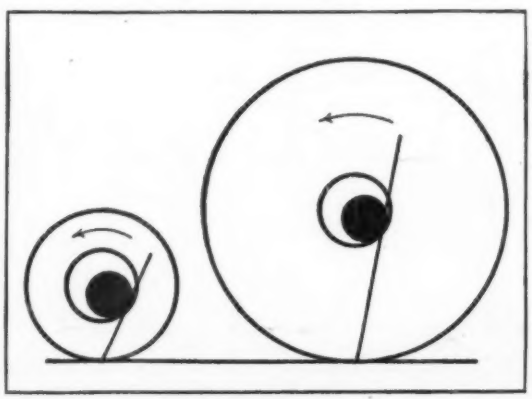


FIGURE 3

In larger wheels, right, the ground reaction is more nearly vertical, and draught is easier than with smaller wheels

The "Why" of Wheels

TO regular readers of the SCIENTIFIC AMERICAN, Mr. Cormac's name is familiar. His articles on engine balance, which appeared in July and August, 1925, aroused much favorable comment, judging from the number of letters which we received. The present series, dealing with idiosyncrasies of wheels, will, we are sure, be received just as favorably.

Many of our readers will agree with the facts put forth by Mr. Cormac, and probably many will disagree with him. The subject is one which affects us all in this era of automobiles, and wheels in general, and much valuable information is to be gained by a thorough study of them. For example, tire wear in automobiles is one of the considerations taken up in the present article.

—*The Editor.*

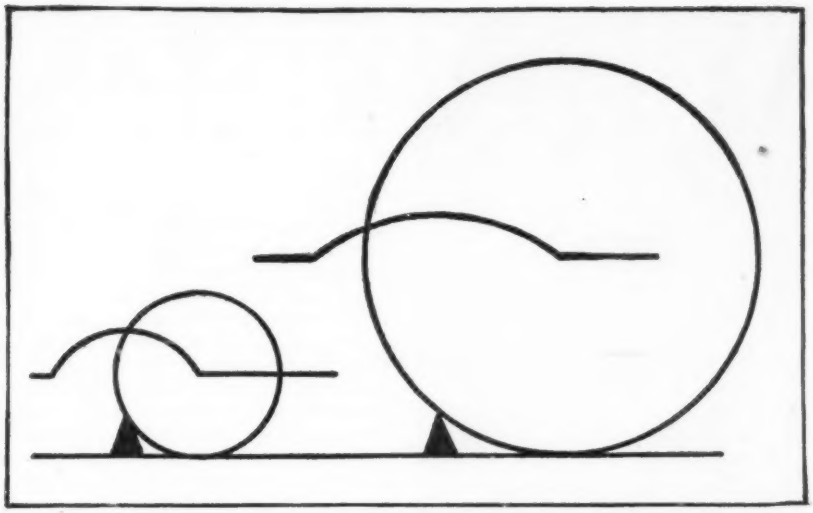


FIGURE 4

In these two drawings, note the curves depicting the paths of the axles. That of the larger wheel is flatter, and therefore, less jar or shock is transmitted to the chassis when riding over a road bump

reaction is more nearly vertical. Two wheels, one double the size of the other, are shown in Figure 3. With the same size axle, it will be seen that the smaller the wheel, the greater is the angle of backward slope of the ground reaction, and in consequence, the greater is the horizontal effect or component opposing motion. Large wheels therefore give much easier draught than do small wheels. It will be evident also from Figure 3, that cutting down the size of the axle will give the ground reaction more nearly vertical, and will therefore tend to reduce tractive effort.

Another advantage of a large wheel is illustrated in Figure 4 which shows the path of the center of a large and a small wheel as they pass over the same obstacle. Although the rise in the path is the same for both wheels, it forms a flatter curve with the larger wheel, and so gives less jar to the chassis. In addition, the energy lost in surmounting the obstacle is greater with the smaller wheel, and further, the smaller wheel is more likely to lose contact with the road which would occasion a still greater energy loss.

A CURIOUS point in favor of a small wheel is shown in Figure 5. The large and the small wheel are running over a wavy surface. When the radius of the wheel is less than the radius of the trough, the path of the axle is a smooth curve as shown for the smaller wheel. When the wheel radius is equal to, or greater than, the radius of the trough, there is a sudden change in the curvature of the axle path, as when the large wheel takes up contact with the road at *B* and breaks contact at *A*. The blow on the tire at *B* causes undue wear, and is transmitted as shock to the axle and steering mechanism.

There is considerable variation in the diameter of wheels for road vehicles. The rear wheels of farm wagons are made about five feet high; front wheels are made smaller—about four feet—to allow a greater angle of lock of the front axle without the wheels fouling against the sides of the cart. The rims of these wheels are made in sections, called felloes, of ash, oak, elm, or beech. The spokes are made of cleft oak, and the hubs or stocks of well-seasoned elm.

The wheelwright favored the construction of large wheels; the long spokes were more easily sprung into the felloes. The old fashioned ordinary bicycle (Figure 6) had a wheel five feet in diameter.

Automobile wheels are usually between 30 and 36 inches in diameter. Weight, body clearance, tire cost, and gear reduction are features which have influenced this figure. The revolutions per minute of the average automobile wheel is 11 times the speed in miles per hour. The speed of a bicycle is the number of revolutions in five seconds.

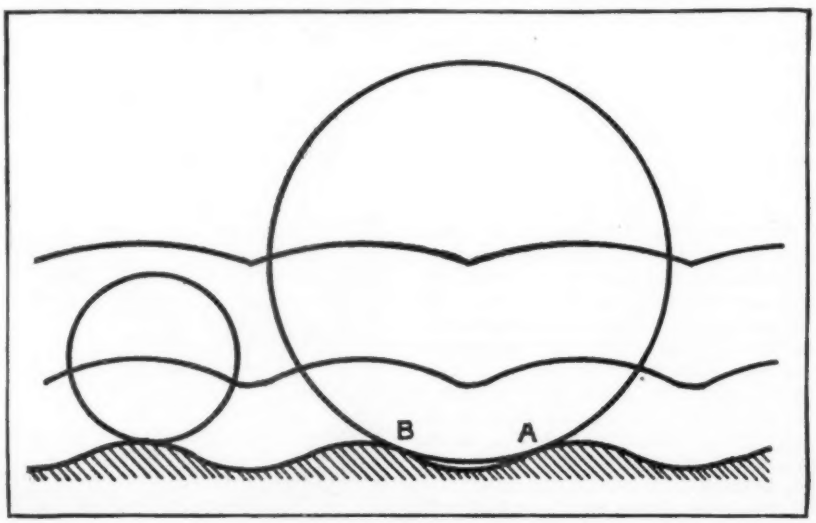


FIGURE 5

When running over a wavy surface, a small wheel follows more closely the surface of the ground, while a large wheel frequently breaks contact. Result—harder riding when on certain surfaces

WHAT may be called the Second Law of the wheel is its sense of direction. If the speed of a wheel or rim be sufficiently high, it will automatically steer itself in a straight course on a level road. This can be readily verified by rolling a coin along a table or floor. For a coin or disk, the minimum speed for straight rolling is the speed which would be acquired by a body in falling from a height equal to one quarter the radius, while for a rim or hoop, it is the same as the speed of a

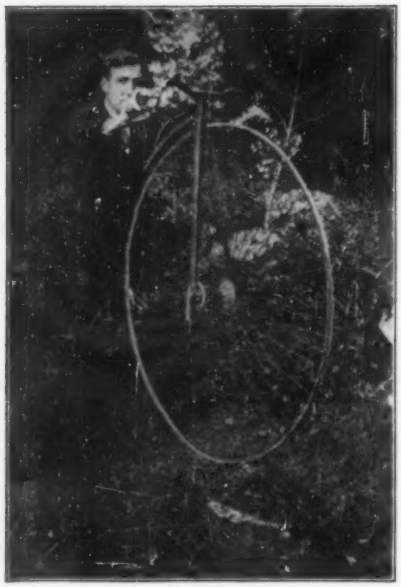


FIGURE 6

Remember this one? The old-fashioned bicycle had a wheel five feet in diameter

body after falling through one third the radius.

A calculation for a 30-inch tire shows that the minimum speed for straight rolling is 4.3 miles per hour, so that it is an easy task to roll a pair of tires if one walks at a brisk pace. At this, or a greater speed, the tire will roll with its plane vertical. When the pace falls below the critical value, the inclination of the rim to the vertical increases while the path becomes curved, the radius of the track decreasing as the inclination of the tire increases.

We have seen that a wheel with its plane vertical will, on a level surface, roll in a straight path. We have now to inquire what is the path of a wheel when its plane is tilted out of the vertical. As with the vertical wheel, the rim being tangent to the ground will touch it at two consecutive points. As the rolling proceeds, the contact point to the rear rises as simultaneously a contact point in front falls on the ground. *These points rise and fall vertically.* Were they to rise obliquely, it would mean that one or other of the pair of consecutive points of contact would slide over the ground. We therefore arrive at the result that the wheel track is the plan of three consecutive points on the wheel rim at the point of tangency.

SINCE the plan of the wheel and the wheel track have three consecutive points in common, the track is the circle of curvature of the wheel plan at the point of tangency. In examining the rolling of a right circular cone on the ground, we arrive at the same result for the track of the disk forming the base of the cone. From the cone analogy, or from the known fact that the center of curvature of a wheel plan at its point of contact is at the intersection of the wheel axle and the ground, we deduce the important practical result that a wheel in rolling pursues a track which is a circle about the point where the axle produced cuts the ground.

Several examples can be given of the application of this principle to steering. The boy with his wheel (Figure 7) watches it steer to the right as its plane leans over in that direction. When a wheelbarrow is to be taken around a curve, the outside handle is raised and the inside handle dropped so that the wheel of the barrow (Figure 8) is inclined towards the center of the curve.

The sociable monocycle, (Figure 9) relies entirely on this principle for its steering. Desiring to turn to the right, the cyclists incline the machine over in that direction, straightening out being

FIGURE 7

A wheel rolling and inclined as shown, tends to steer in the direction in which it leans

accomplished by adjusting the wheel to the vertical position. The changes in the inclination of the wheel are brought about by one or both cyclists leaning over to alter the position of their common center of gravity with respect to the machine.

It may be remarked that to run this cycle straight along the edge of a cambered road, its plane would have to be maintained inclined so as to be perpendicular to the road surface. The same remark applies to a wheelbarrow run across a sideslope. If the wheel be maintained plumb, the barrow tends to run uphill. If an elliptical wheel be fitted, it is interesting to observe the wobble on a curved track due to the varying curvature of the wheel plan at contact.

We have shown that a wheel rolls naturally in a track which is the circle of curvature of the wheel plan at the point of road contact. The track and wheel plan, in this case, have three consecutive points in common, or contact of the second order. The wheel, however, can travel without sideslip if it pursues a track which has but two consecutive points in common with the wheel plan. This means that the wheel plan and the wheel track still touch each other, but with contact of the first order only. This condition is satisfied when the wheel runs in a circle which has its center at any point on the plane of the wheel axis. When, therefore, a wheel cannot pursue its natural rolling path, it will endeavor to turn about some other point on the production of the axle.

ALTHOUGH there is no sideslip of the tire over the ground when the track and wheel plan have contact of the first order, the action is not pure rolling but a combined rolling and spinning. The spinning involves the sliding of one of the consecutive points of contact over the ground while the other point maintains contact. A case of pure spinning is exemplified by a coin twirling like a spinning top on a table.

As an example of wheels prevented from pursuing their natural rolling path, we may take the front wheels of an automobile. These wheels are inclined outwards as shown in Figure 10. The cant or camber varies from two to six degrees, or what is the same thing, the tops of the wheels are from two to six inches farther apart than the bottoms. The natural rolling path for the left-hand wheel is the circle which has its center at V, the point where the stub axle produced cuts the ground. The wheel may correctly be regarded as the base of a cone having its apex at V. Plainly the left wheel

FIGURE 8

A wheelbarrow is steered by raising one and lowering the other handle, inclining the wheel

tends to roll to the left, and the right wheel to the right. This, being impossible on a straight course, involves spinning of the tire on the ground.

TWO degrees of camber give a spinning rate which is 3¼ percent of the revolution rate. At 40 miles per hour, corresponding to 440 revolutions per minute of the road wheels, the spinning action is at the rate of 15 revolutions per minute. If it be considered that this is equivalent to turning the steering wheel from full lock on one side to full lock on the other side at about 90 times a minute,

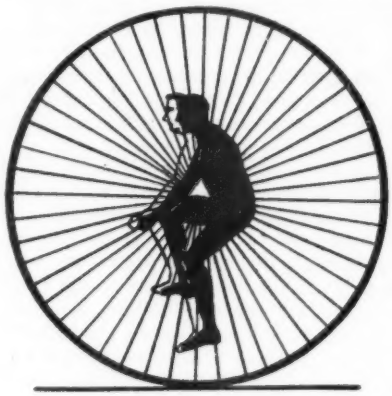


FIGURE 9

In the sociable monocycle mentioned in the text, there are two riders placed side by side

the wear of tires and loss of power entailed will be realized.

If the road be cambered so that the surface becomes normal to the wheels, the spin action is eliminated. It is of importance, therefore, that the camber of front automobile wheels be coordinated to the average camber of the concrete road. A road 24 feet wide, finished to a circular arc giving a 4½-inch rise in the center, would take a two-degree setting of front wheels to bring them normal to the cross-section of the road surface.

Nothing can be done to eliminate the spinning action of rear wheels on such cambered roads, for the rear tires, being vertical, must spin unless the cross-section of the road be straight.

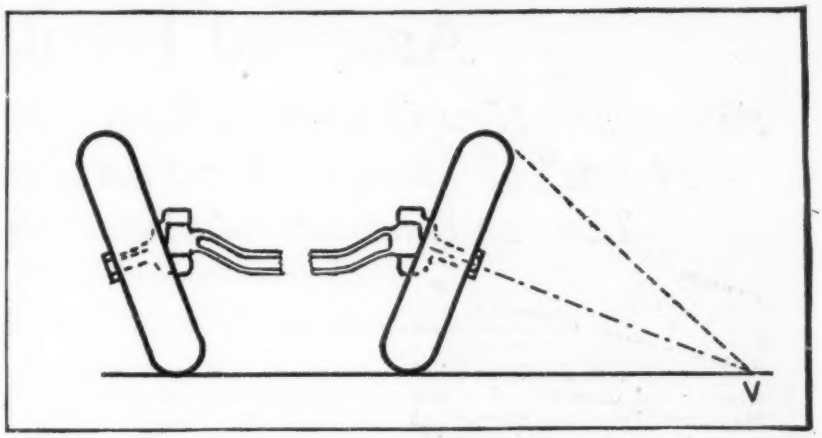


FIGURE 10

The front wheels of an automobile are cambered from two to six degrees, exaggerated above. This camber is necessary in order to insure complete stability when on a straight course

Front tires, having no driving torque to transmit, should wear much longer than rear tires. The spinning action noted accounts in part for the fact that they wear as quickly, if not more quickly, than rear tires. This is more pronounced with balloon tires on account of the greater contact area. Want of alignment of balloon tires is a serious cause of wear. A front tire is under tension at the portion which impacts on the road, whereas a driving tire is under compression at this point. This may account for the more damaging effect of the roadway on front tires.

The wheels of horse-drawn vehicles are given a camber of about 15 degrees. This applies to both front and rear wheels. The reason for this camber arises from the dishing of the wooden wheels of farm carts, wagons, and carriages. The spokes, in radiating out from the hub or stock, also come forward away from the cart, giving the wheel a saucer or dish shape. This construction enables the wheel to resist large side-forces without becoming distorted.

Wheel loads due to sidesway of the cart are taken up as a compression in the spokes of one or other of a pair of the wheels. With a flat or undished wheel, side forces put the spokes in tension, thus pulling them out of their sockets. So that a dished wheel may "torque on every spoke," that is, have the spoke vertical as it comes directly under the axle, the wheel must be given a camber setting corresponding to the angle of dish.

The spin action, introduced by the camber setting of wheels, tends to give stability to the straight course of the vehicle. A deflection of the vehicle to the left diminishes the rate of spin of the left wheel and increases that of the right wheel. The twisting effect (in the steering sense) on the wheels, due to the excess spin of the right wheel over the left, tends to pull them back to the straight course. We may instance here the effect of the coring of locomotive tires in preventing "nosing" of the engine.

Locomotive tires are turned to a template sloped 1 in 20, (Figure 11). As the rail is sloped to correspond to the core of the tire, the effect is the same as a camber of three degrees given to automobile wheels. The 1 in 20 slope of the tire gives a spin between the tire and the rail at the rate of one complete spin for 20 revolutions of the wheel. As with the automobile, the spin tends to keep the locomotive on a straight course, since deviation one way or the other gives a resultant spin tending to restore the axles to the straight and therefore tending to hold the locomotive steady.

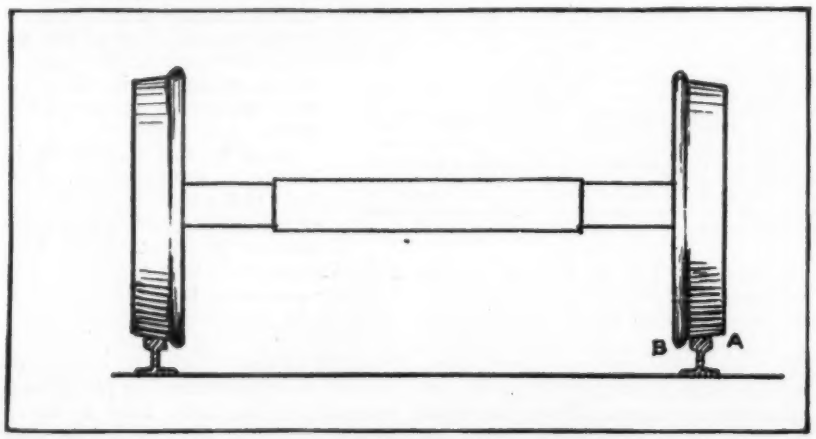


FIGURE 11

The tires on locomotive wheels are turned with a down slope from A to B. This has the same effect as the camber of the front wheels of the automobile, as shown in figure 10 at right above

¶ *In our December issue, we will present the second article of this series on wheels. We can assure our readers that it will be as interesting as the present one, and will be well worth waiting for.*

Asteroid Hunting

Astronomers Now Conduct the Search for Asteroids or "Pocket Planets" by Modern Mass-Production Methods. Is There an Undiscovered Planet Beyond Neptune?

By HENRY NORRIS RUSSELL, Ph.D.

Chairman of the Department of Astronomy and Director of the Observatory at Princeton University
Research Associate of the Mount Wilson Observatory of the Carnegie Institution of Washington

IF the average man should be asked whether the discovery of a new planet would count as an important item of news he would probably reply in the affirmative; and, interpreting the word "planet" as he probably would to mean a body comparable in size with the Earth on which we live, he would be entirely right. Only two planets of this sort—Uranus and Neptune—have been discovered since history began to be written, and in both cases the discovery aroused the widest and liveliest interest.

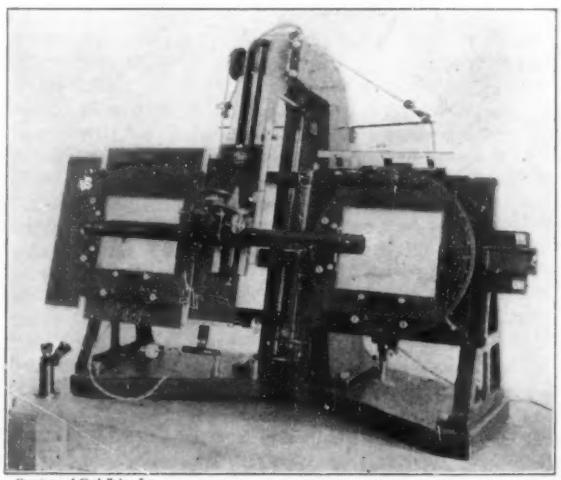
But if a planet is defined as astronomers are wont to do, merely as a body pursuing an independent orbit about the Sun, the discovery of one more or of a dozen is hardly news at all. The daily press is likely to pass it over entirely, and even in the technical literature of astronomy the announcement will occupy little space and create no excitement.

THE reason is, of course, that small planets—or as they are commonly called, "asteroids"—are so abundant that the discovery of a few more is of interest only to a few specialists.

More than a thousand of these little bodies are already listed in the latest of the annual supplements to the German Nautical Almanac, which by international agreement publishes the latest data on the subject. The best list is increasing by 20 planets or so a year, and it is probable that another thousand or more will yet be added before the tale comes to an end.

With such numbers to deal with, astronomers suffer from an embarrassment of riches, and it is clear that something like the methods of "quantity production" must have been applied in this field of science, in order to give us as much knowledge as we have. This is indeed the case, especially in the matter of discovery. One can fairly promise a graduate student of astronomy that if he can secure the privilege of observing with a suitable instrument he will be able to discover at least half a dozen planets, and probably many more, in a year's work.

No one can tell an asteroid from a star, merely by looking at it. Except for three or four of the very brightest which have been known for more than a century, they appear only as faint, luminous points without perceptible diameter. They can be picked out only by their motion. In the old days, until about 25 years ago, it was a very hard job to find the one moving asteroid among a thousand fixed stars.



Courtesy of Carl Zeiss, Inc.

THE STEREOCOMPARATOR, WITH BLINK MICROSCOPE

Finding the needle in the celestial haystack is quick work with the ingenious blink microscope. It is used for ascertaining slight differences between two otherwise identical photographic plates. The two plates are mounted in the apparatus and viewed alternately from a single eyepiece (through a series of reflecting surfaces) by an oscillating device which shifts the view from one plate to the other in rapid succession. If the two plates, each of which may show thousands of stars, are wholly identical, they will look like a single plate; but if there is any slight difference, such as a new star or an asteroid in a new position, that object will be revealed instantly as a dancing spot; that is, it will "blink." The former method of comparison was simply by "main strength and awkwardness:" the worker examined the two plates systematically, minutely—and endlessly!

The observer had to prepare an accurate chart of some selected part of the heavens, showing all the stars visible with his telescope, and then to search this region over and over again, looking for some faint star which did not appear on the chart. If one was found it often turned out to be a variable star which had increased in brightness since the chart was made; but sooner or later patience was rewarded by the discovery of some object which shifted its place from night to night, and a new planet was added to the list. The fact that more than 200 asteroids were discovered in this exceedingly laborious fashion bears eloquent testimony to the assiduity of the earlier observers.

But photography opens the royal road to discovery of this sort. The modern observer provides himself with a camera of large aperture of lens and wide angle of field, or preferably with a pair of such instruments on the same mounting. Picking out any suitable region of the sky, he puts in a pair of plates and exposes for two or three hours, guiding carefully meanwhile so that the star images on his negatives are sharp round dots. The motion of an asteroid during two hours is rapid enough to draw out its image into a quite perceptible trail or streak which can be picked out at once among the thousands of stars. The duplicate plate guards against any danger of being deceived by some trail-like marking due to a defect on the plate.

BY this method—invented by Professor Max Wolf of Heidelberg—asteroids may be discovered literally by wholesale. Those which have previously been known are of course picked up with the others, so that the work of the earlier visual observers is repeated with but a small fraction of the labor.

Good as this method is, it has one disadvantage. The light of the stars which are not of intense interest in this connection is concentrated into point-images, while that of the asteroid is drawn out into a trail and enfeebled. If we knew just in what direction the asteroid was moving and at what rate, it would be easy enough to adjust our guiding so as to follow the planet and concentrate its light into a sharp image, while the unwanted stars were drawn out into trails.

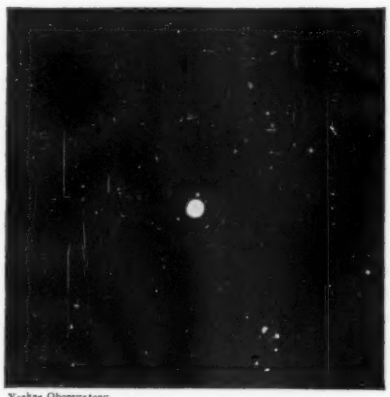
Of course, we cannot say exactly

what the motion of an undiscovered asteroid will be, but we can at least adjust our apparatus to follow the motion of an average asteroid. Individual small planets whose motions differ from the average will then show on our plates as short trails, while the stars appear as longer ones. This method, which greatly increased the effective power of the camera, was invented by an American amateur astronomer, Reverend J. H. Metcalfe, whose death a few years ago was a great loss to this branch of the science.

With "scientific management" thus applied to the problem, the discovery of asteroids is almost too easy. Indeed, they have been found faster than they can be looked after.

THE discovery of any heavenly body, of course, is only the beginning of a long course of activity. In the case of a planet we need to know its orbit so that we can calculate in advance where to look for it in future years. To calculate this orbit is our next problem.

When the first asteroid, Ceres, was discovered in 1801, this problem was altogether new—and it is by no means easy. The great mathematician Gauss solved it within a few months, so that the planet was found the next year close to the calculated position. Later investigators have improved the practical details of the calculations without adding much to the general principles on which they are based.



Yerkes Observatory

URANUS AND TWO SATELLITES

Photographed by Hubble, at Yerkes. It was by the gravitational pull (pertubations) on Uranus that Neptune was first discovered

Three good observations of the planet's place in the sky suffice under ordinary circumstances for a solution of the problem (occasionally a fourth observation may be necessary). From accurate observations ten days or so apart a good determination of the size, shape, and position of the orbit can be made, but things do not always work out so nicely.

In the first place, faint asteroids can not be photographed in full moonlight, which fogs the plates. If the Moon comes along at the wrong time, only one or two observations may have been secured, and after the Moon is out of the way it may not be easy to find where the faint, moving speck has gone. Many asteroids are thus lost immediately after discovery and before there is any chance of getting an orbit. The whole number of these runs far into the hundreds.

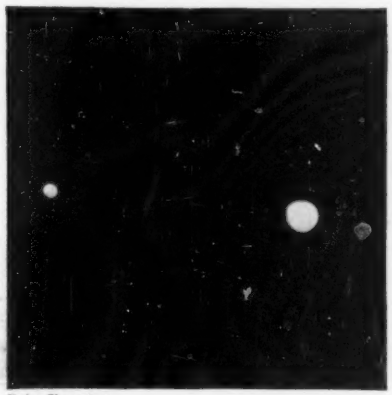
Again, if these observations have been secured, one of them may be wrong by some small amount. The mathematical formulae lead to an orbit which agrees perfectly with the observations on which it is based; but if these observations are wrong, the calculated orbit will be wrong too—and the error may be greatly magnified. In particular, the period of the planet may come out a little wrong. The effect of such an error is cumulative with the lapse of time, and after a few years the calculated position may be hopelessly far from the real planet. In this way, too, a good many asteroids have been lost.

SUCH losses are, however, only temporary. As the work of systematic discovery continues, the lost planets sooner or later will be picked up again, unexpectedly. If on the second occasion a good orbit has been determined, calculations of the position of the asteroids in past time will show whether it is identical with any of the lost planets of earlier years. Several long-lost planets have been recovered in this way, some after 30 years or more.

When a good orbit has been obtained from observations in one season, the position of the planet at the next opposition rather more than a year later can be predicted. A search for it is then easy and it is likely to be found, except in a few cases where it is much farther from the Earth than before, and hence very faint. It is rarely if ever found exactly in the computed position, but from the discrepancy it is possible to calculate more accurate values of the elements of the orbit which represent the observations of both years.

When the process has been carried on for a couple of more oppositions a reliable orbit can be obtained and the elementary part of the problem is solved so far as this planet is concerned. More and harder work has still to be done, for no account has yet been taken of the complications, due to the fact that the planets as well as the Sun are attracting the asteroid. But the story must wait until next month.

Meanwhile a word may be said upon the question of the possible existence of another large planet besides those at present known. Photographs taken during total solar eclipses have shown that there can be no planet bigger than a smallish asteroid inside the orbit of Mercury. Is there a planet beyond Neptune? Many attempts have been made to find such a body from the perturbation of Neptune and of Uranus, as Neptune itself was found by means of the perturbations of Uranus. The general outcome of these investigations indicates that an outer planet, if it exists, must be rather small



Yerkes Observatory

NEPTUNE AND SATELLITE

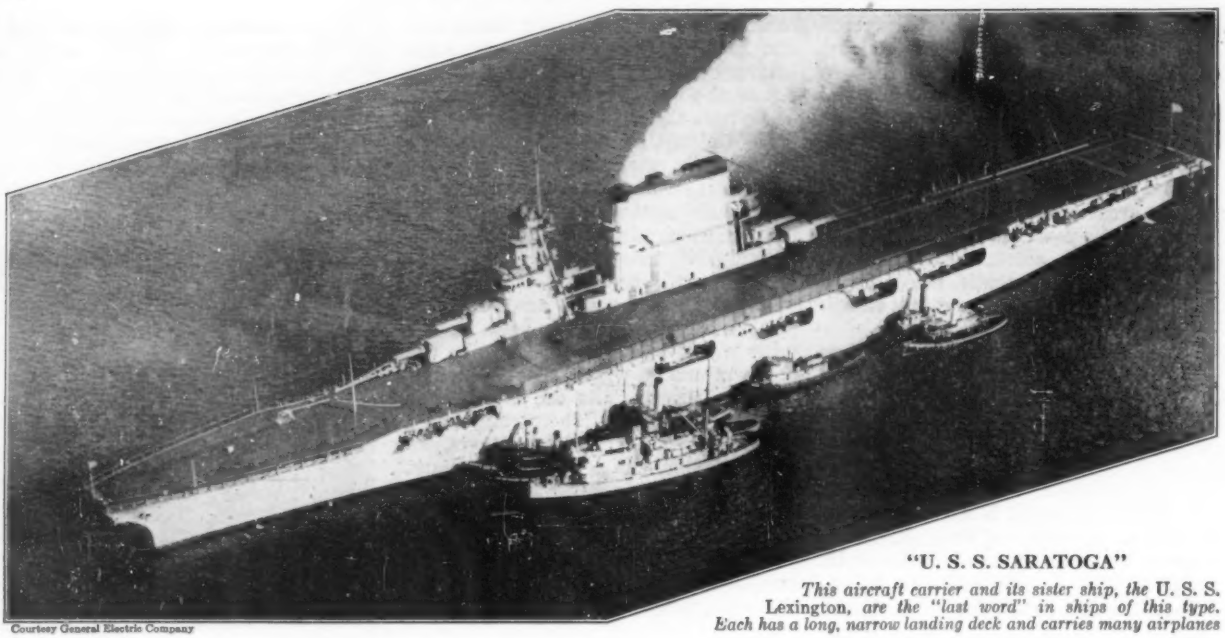
Photographed at Yerkes. Neptune was discovered in 1846 as a result of a deduction by Leverrier who noted its pertubations

—probably considerably smaller than Neptune and too small for its attraction to produce sensible disturbances of the inner planets.

SUCH a planet, nevertheless, might easily be within the range of brightness accessible to modern photographs with instruments of moderate power. A search for it by the photographic method would be well repaid. The routine of the asteroid hunters would require small modifications, for the planet's apparent motion would be slower and its trail on a two-hour exposure very short. By taking plates on consecutive nights, and comparing them with the blink microscope, the planet's motion would become conspicuous and could be picked out at a glance.

The campaign would demand the taking of perhaps a hundred plates in duplicate, extending step by step all around the ecliptic; and the examination of millions of star images. Whether a trans-Neptunian planet would be found depends on whether one is there to find; but the knowledge that there was no such planet brighter than a given limit of stellar magnitude would be worth the labor of an unsuccessful search. Moreover, the by-products in the discovery of asteroids, variable stars and the like would give the observer plenty to do—perhaps more than he had time for.

¶ *Analysis of metals by means of their spectra is a method which promises to grow in popularity because of its efficiency. A description of this work will appear in a future issue.*



Courtesy General Electric Company

"U. S. S. SARATOGA"

This aircraft carrier and its sister ship, the U. S. S. Lexington, *are the "last word" in ships of this type. Each has a long, narrow landing deck and carries many airplanes*

Naval Adequacy—III

Comparison of Naval Strength in Ships, of Great Britain, Japan, and the United States, Shows the Weakness of Our Fleet

By CAPTAIN N. H. GOSS, U. S. N.

WE have seen how naval strength depends inherently upon naval bases and how the strength of a fleet depends upon types. We shall now consider how naval strength further depends upon relative numbers of these types and how the various classes within these types differ in comparative value.

The diagram on the opposite page shows graphically the comparative numbers and tonnage of the principal types of fighting ships owned by Great Britain, the United States, and Japan. Of these ships, as everyone knows, only capital ships and aircraft carriers are limited, having been standardized at the Washington Conference. Comparative fighting strength of these fleets, however, depends upon a great deal more than actual tonnage and numbers, as we shall see.

The British and Japanese fleets each include four battle cruisers among their capital ships. The World War and stategic game board studies have shown the value of ships of this type. They can act as a protective screen strong enough to drive off enemy cruisers that are seeking information, or as an offensive screen fast enough and strong enough to seek information in comparative safety far ahead of the fleet. They are valuable for raiding enemy communications, and destroying and scattering the enemy's slow convoys; or to act as an advanced wing with the battle fleet, fast enough to reach decisive points quickly, and strong enough in gun-power to fight at extreme ranges. Their heavy guns enable them to out-class any cruisers while their speed enables them to keep away from enemy battle-ships, and greatly facilitates avoidance of submarine attack.

JAPAN'S four battle cruisers are particularly valuable to her, operating as they do from her secure network of bases and, in the event of war with us, against the exposed line of communications we would have to maintain in any movement to cover our possessions in the western Pacific. They are stronger than any combination of cruisers that could be brought against them, and could out-run and outmaneuver our battle-ships with impunity. They are actually more valuable to Japan than would be their equivalent ratio in battle-ships, since their strategy could prevent their battle fleet from locking arms in a broadside encounter with our battle-ships.

The Singapore base, Hong Kong, and the network of harbors in and about the Carribbean, available to the British for shelter and fuel, would permit their battle cruisers much freedom of action; and it must be remembered that superior speed permits its possessor to choose his own time and terms.

It has long been the policy of our navy to give our battle-ships the maximum in gun-power, armor, and protection even at the expense of speed. This seems sound because, situated as we are without numerous bases, our capital ships must be able to withstand heavy punishment on the high seas; but, as before indicated, even battle-ships differ among themselves, the latest to be built being naturally the best.

Our custom before the World War of laying down two battle-ships a year resulted in a battle-ship force that is not homogeneous. For example, six of our battleships have 12-inch guns. These are considerably less powerful than the guns mounted in the capital ships of the other two nations under consideration.

None of these British ships mount guns of less than 13.5-inch bore—the practical equivalent of our 14-inch—while 10 British battle-ships and three

of their battle cruisers mount 15-inch, and their two new battle-ships carry guns of 16-inch caliber.

Two Japanese battle-ships mount 16-inch guns and Japan's remaining battle-ships and battle cruisers carry 14-inch guns. Our three latest battle-ships carry 16-inch guns and the remaining nine mount 14-inch. These guns actually differ considerably in striking power. While 14-inch and 13.5-inch guns may be considered adequate, a 12-inch shell is too light to be effective at modern battle ranges.

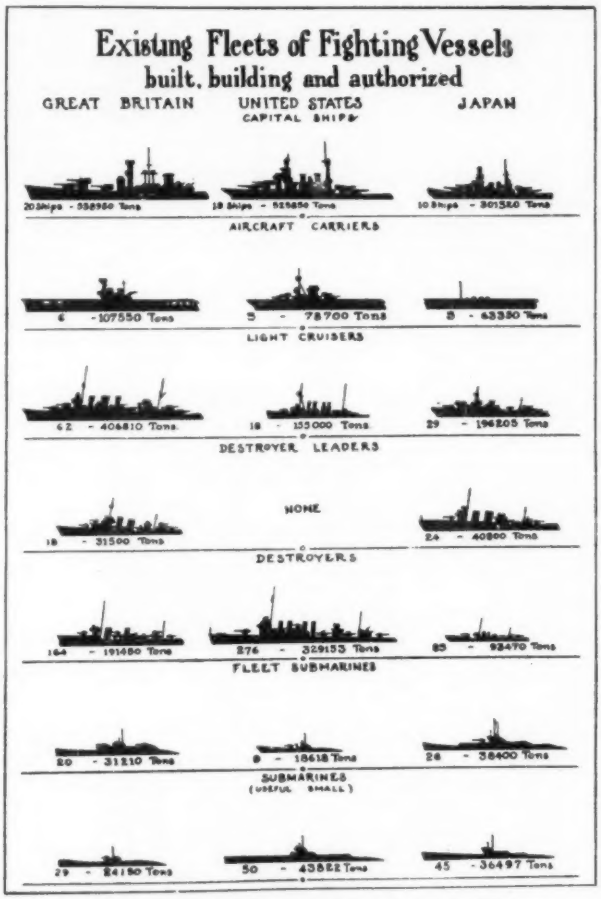
All the foreign capital ships, with the exception of the four British "Iron Dukes," are faster than ours. The battle cruisers naturally are much faster by from six and one-half to 10 knots. The five British "Queen Elizabeths" are four knots faster, while the speed of their two new "Nelsons," their five "Royal Sovereigns," the two Japanese 16-inch gunned "Nagatos," and the two Japanese "Ises," is 23 knots. The two remaining Japanese "Fusos" have a speed of not less than 22 knots. So all of the foreign capital ships, except the four oldest British ones, are superior to ours in speed, some of them markedly so.

NOT only do the British have two more capital ships than we, but one of these is the giant *Hood*, the greatest war vessel ever built. It is more than 7000 tons greater than any we will be permitted to build in the future, its size being sufficient to combine the adequate under-water protection and gun-power of a battle-ship with the speed of a light cruiser.

The Japanese with their compact, high-speed capital ships, operating from numerous bases, have an advantage in the region about our possessions in the Far East that our greater tonnage in slow capital ships does not neutralize. We now begin to see how inferiority of classes or lack of an essential type, handicaps a fleet and weakens actual naval strength.

No power has yet built up to the limit of the tonnage prescribed for the comparatively new aircraft carrier type. The great size of the largest yet built—the two of the "Saratoga" class built by this country and the *Akagi* and *Kaga* by the Japanese—is due to conversion of vessels already laid down at the time of the Washington Conference. While ships of this extreme size, capable of battle cruiser speed, undoubtedly have great tactical advantages in that they could quickly deliver a great number of airplanes at a decisive point, all plane carriers are so vulnerable above water that it is doubtful whether any country would again place so many eggs of the authorized tonnage in one basket.

Most of the British carriers are also converted vessels, the *Eagle* being built upon the hull of a battle-ship, and the *Furious*, *Courageous*, and *Glorious* from the three large "hush-hush" cruisers built by Lord Fisher during the war.



NAVAL STRENGTH GRAPHICALLY SHOWN

The sizes of the silhouettes indicate the relative strength of the three navies under discussion here. Note that we have no destroyer leaders

Only one, the *Hermes*, represents an original design from the keel up.

While the plane carrier is undoubtedly still in process of evolution, its value has already been demonstrated and the comparative strength of these vessels with their accompanying planes is not far different from the ratio of actual tonnage. The greater number of British carriers, three of which are also of battle-cruiser speed, probably offsets the larger size of our two new ones. It is to be noted also that the *Kaga*, converted from a battle-ship hull, is also credited with a speed in excess of 25 knots, and that the *Akagi* is built upon a battle-cruiser hull, so that the Japanese strength in this type is comparatively high. Of the lot, the three British of the "Furious" class are, doubtless, the most vulnerable under water, but their high speed should considerably safeguard them from submarines.

The light cruiser is probably the most widely discussed type at present, as it is a most important vessel. As is now generally known, the Washington Conference established a size limit in tonnage and guns for this type, but did not fix any limit to effective age or numbers. The diagram tells the story very graphically in this case. Both the British and Japanese have been not only convinced of the value of this type, but have been quick to build as well the new class established by the Washington Treaties. As it stands now, they each have an overwhelming superiority in this type.

This modern cruiser is quite a different vessel from its predecessor, the slow, coal-burning, armored or protected cruiser that obtained previous to 1910.

THESE later vessels are oil burning, of considerable gun-power, excellent sea keeping qualities, all of considerable cruising radius, and have comparatively better water-tight sub-division than their predecessors. In fact, during the war they successfully withstood an almost incredible amount of punishment. The British, as a result of their experience during the war, developed classes of these vessels to work with the battle fleet and adapted to base upon their numerous harbors; and the Japanese quickly followed suit. Each of these nations now has a numerous force of these vessels, all modern and all comparatively new. In addition, each has proceeded to lay down an extensive program of the new 10,000-ton class, often referred to as the treaty cruiser. Of these, the most powerful class permitted, the British have authorized 16, of which seven of the "Kent" class, four of the "London" class, and three of the "Norfolk" class, have already been laid down. They have also authorized seven of the "York" class of 8000 tons —of which one has already been laid down—a somewhat smaller cruiser well adapted to their use by virtue of their extensive bases. This latter class as well as all the other large ones, carries 8-inch guns, the largest caliber permitted by the Washington Treaties.

So, out of a total of 62 of these modern cruisers authorized, the British have no less than 53 already built or actually laid down. When we consider how the British network of bases and fueling stations throughout their strategic areas and along their lines of communication augment the relative strength of vessels by what amounts to an increase of numbers, it is easy to see what a very powerful cruiser force the British have at the present time.

THE BACK-BONE OF THE FLEET

United States battle-ships passing the Golden Gate and entering San Francisco Harbor. In the right center foreground may be seen the wings of one of the airplanes carried by these ships

The Japanese cruiser strength, listed in the diagram, is likewise all modern and includes six of the maximum treaty class, four of this "Nachi" class having been laid down. We have already seen how the Japanese interior lines, resting on numerous bases in the Far East, strengthen their position there for which even their smaller cruisers, especially when so comparatively numerous, are well adapted.

OUR own story of modern cruisers is quickly told. We have the 10 7500-ton ships of the "Omaha" class, mounting 6-inch guns, that were under construction at the time of the Washington Conference, and eight of the 10,000-ton class subsequently authorized, on only two of which—the *Pensacola* and the *Salt Lake City*—has any substantial progress been made. Here it may be noted that the only way we can overcome our lack of suitable bases is by building cruisers of this larger class which alone can have the cruising radius and habitability to remain at sea for the long periods and at the great distances necessary.

At the close of the World War, each of the principal naval powers had a considerable force of older cruisers. Most of these, however, were quite obsolete and very vulnerable to all forms of attack as shown by the three "Cresseys" sunk by one submarine, by the *Warrior* and *Defense* which were quickly sunk by gun-fire at Jutland, and by our own *San Diego* which was sunk by one mine. In fact, they were veritable death-traps and, by reason of their slow speed and short cruising radius, were of little or no military value. The British were quick to realize this and scrapped 33 of them. The Japanese and ourselves have, so far, retained them. We have actually 22 totalling 179,425 tons, dating from Sampson's flagship, the former armored cruiser *New York*—renamed the *Rochester*—which was laid down in 1890, to the *Missoula* dating from 1905. The Japanese also have a number of these old cruisers—15, in fact—of 98,176 tons. Of these, the three "Chikumas" laid down in 1910, have some considerable value for operating on their interior lines.

In addition, however, to the obsolete cruisers scrapped by the British, they also retained a number of their earlier light cruisers—nine, in fact—of 48,380 tons, the oldest being the three "Dartmouths" dating from 1910 and including, as well, the *Adelaide* which was laid down in 1917 but which is too slow to be classed as a modern light cruiser. Here, again, the numerous British bases give some value to these nine vessels.

From the diagram we note that we have no destroyer leaders. To anyone who has attempted to handle destroyers with the fleet during maneuvers or on the game board, the magnitude of this handicap is quickly manifest. We are unable fully to utilize the great potential value of our destroyer force, the one type in which we exceed in present strength of vessels. Of leaders, the British have 18, presumably the number their experience indicated they needed. The Japanese have also gone in extensively for this type, of which they now have 24 large enough to be classed as leaders.

As the result of our war-time effort to overcome the submarine menace, we have a very large force of destroyers—all valuable vessels although more than half of them are greatly handicapped in steaming radius due to the type of machinery it was necessary to use during the rush of war-time construction. The British have 164 of their sturdy destroyers and the Japanese already have 83, mostly of post-war construction. Each power has a number of the older, smaller torpedo boats not included in the above considered tabulations. We have 33 of 28,515 tons; the British have six of 4200 tons; and the Japanese have 12 of 7850 tons. As these complicated, delicate vessels grow obsolete rather quickly, these older ones are considered of little, if any, military value.

SUBMARINES are of two general types, as indicated by the diagram and in the previous discussion. Of these, only the larger type is really habitable for any considerable time at sea. Included in our total are three of the "T" class, designed before the war and already practically obsolete since they do not embody the valuable lessons taught by experience during the great war. Our six new ones of the "V" class are the beginning of a force of these valuable vessels. All of the British vessels of this larger type were constructed during or since the war and most of them are valuable vessels. All of the Japanese fleet submarines are of post-war construction and Japan is considered to have by far the most effective and up-to-date submarine force of this type, a force not limited in cruising radius to the defensive area around their home islands.

Of smaller submarines, the 50 of ours listed comprise the "S" class, the only ones large enough to operate away from a shore base. All of these were designed during the war and are not considered comparable, in efficiency, with the post-war-designed Japanese boats or with the British submarines of later classes. However, they have

considerable military value. This is one class in which we have appreciable strength but here, again, our weakness in bases is a tremendous handicap, while the well-disposed bases of the British enable them to utilize even their smaller submarines to good advantage. This is true also to an even greater extent for the Japanese.

Of the older and smaller submarines not listed in the diagram, our 27 "R" boats have some value for operating from shore bases, but this value is limited. Our oldest classes are not considered to have any value. Great Britain has 23 of these older submarines of equal, or greater, value than ours since they are of later design; and Japan has 10, also mostly obsolete. The Japanese are actually superior in combined submarine strength as practically all their boats are of recent construction.

Aircraft are built so quickly nowadays and their design changes so rapidly, that it is difficult to make any accurate comparisons. Each country, however, has home bases in which to develop the art and train its personnel. The Japanese home bases—particularly the one at Kagoshima in southern Kiushu—are close enough to link up by air alone with many of the outlying Japanese actual, or potential, naval bases. The plane carriers of the different powers carry planes in numbers generally proportionate to their size, although greater numbers of smaller carriers carry comparatively more planes. This is offset somewhat in our case, perhaps, by the superior speed and tactical characteristics of our giant carriers which can quickly bring a great force of combat planes to a decisive position.

IN addition, our battle-ships and cruisers carry their own spotting and observation planes. The ships we have are better fitted in this respect than those of the British and better, probably, than the Japanese ships. Of the three navies, our own has probably devoted the most attention to a rational and systematic development and use of aircraft for naval activities. Much effort has been made in our service to develop aircraft as an arm of the navy; consequently our naval aircraft are well adapted for naval purposes.

Our five-year aircraft program is well under way and planes have been ordered for our authorized cruisers; also, a beginning has been made on planes for the naval reserve. There is little doubt that we are superior to other navies in this modern fighting arm, in efficiency as well as in numbers, since naval aviation, being part and parcel of the navy, has been specifically developed to fit naval needs.

Were there no men-of-war, seapower would automatically pass into the hands of the power possessing the greatest merchant marine. All vessels of any appreciable size, say of 2000 tons or over, may readily mount guns; sizeable vessels, say of 4000 and 5000 tons and above, readily mounting five-inch and six-inch guns. Some idea of the strength ratio on this basis may be gleaned from the following tables showing number and tonnage of ships owned:

20 KNOTS AND OVER

	Ships	Tons
Great Britain	12	351,041
Japan	2	10,524
United States	2	58,313

18 KNOTS AND OVER

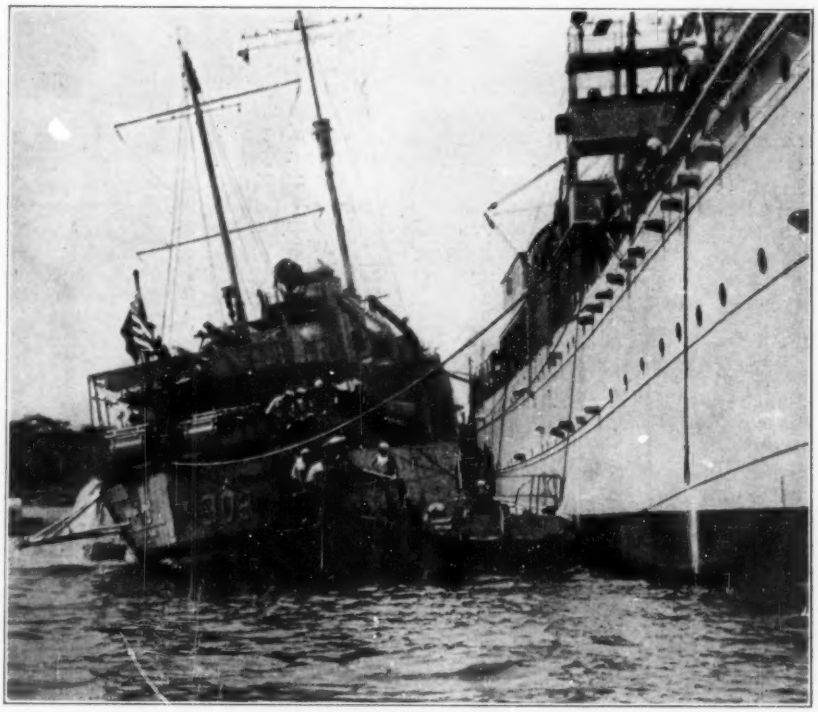
Great Britain	38	767,201
Japan	2	10,524
United States	6	134,538

16 KNOTS AND OVER

Great Britain	145	2,109,729
Japan	10	93,589
United States	37	452,874

14 KNOTS AND OVER

Great Britain	435	4,569,367
Japan	56	416,501
United States	101	940,512



EMERGENCY REPAIRS

Destroyer tenders are equipped with caissons by means of which damaged propellers may be renewed and minor underwater repairs may be made away from navy yards. Such repairs are being made here, the destroyer being tilted so that work may be done below the water line

12 KNOTS AND OVER

Great Britain	1280	9,532,508
Japan	206	1,169,190
United States	235	1,706,850

Recent construction of merchant vessels is strikingly illustrated by the following tables:

Ocean-going vessels of 2000 tons and over building during the period—1921 to 1926:

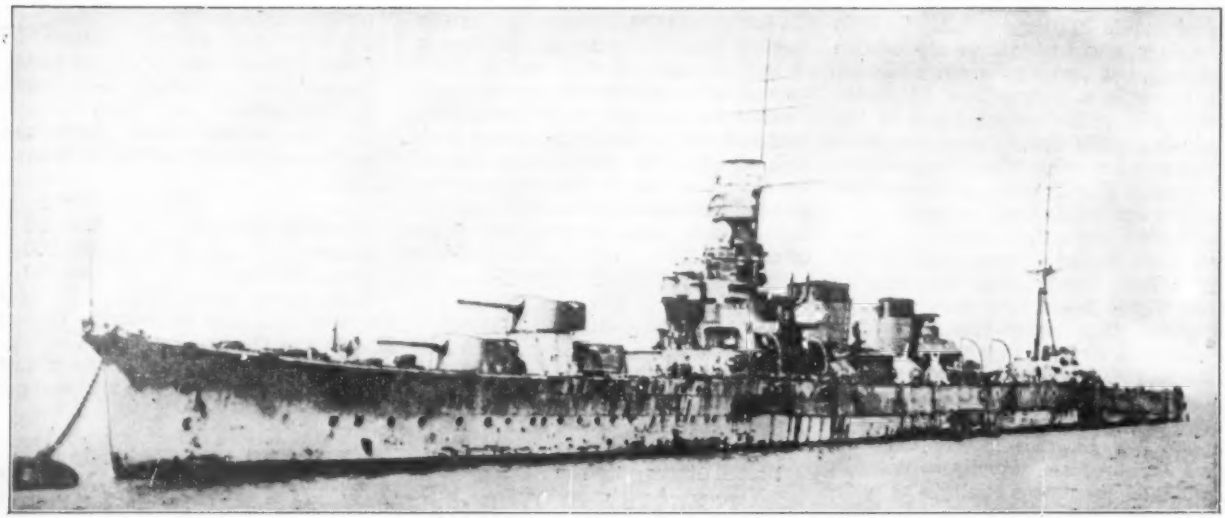
	Ships	Tons
Great Britain	600	3,500,000
Japan	52	250,000
United States	14	137,000

At the present time, there are actually under construction the following:

	Ships	Tons
Great Britain	142	908,000
Japan	19	100,000
United States	4	63,000

The above graphically illustrates the overwhelming superiority of the British and the great margin the Japanese have in the Far East in merchant vessels, all of which have an inherent bearing on naval strength.

ALTHOUGH the Washington Conference standardized only capital ships, and aircraft carriers, and limited only the maximum size of individual cruisers, the 5-5-3 ratio quickly became an established principle in the minds of our people. As intimated heretofore in this series, however, the Conference did fix one other limitation which has, as we have seen in the discussion of bases, a very material effect upon our naval strength in and about our possessions in the Far East. As explained before, the Japanese were unwilling to consider the limitation of any types of ships until we had agreed, by treaty, not to establish any fortifications in the Philippines, Samoa, the Aleutian Islands, or Guam. As this



"H. I. J. M. S. FURUTAKA"

A Japanese cruiser. By the novel gun arrangement shown, the Japanese are able to mount six eight-inch guns on a displacement of less than 7500 tons and still obtain a speed of 33 knots by curtailing the supply of fuel and stores. Numerous bases enable them to do this

agreement did not mention the mainland of Asia, the question of British expansion in their leased territory of Kow Loon, opposite Hong Kong, is unsettled, and the treaty does not apply to islands east of the 110th meridian, which embraces Singapore.

To summarize, then, the extent to which we can exert the potential strength of our capital ships and plane carriers in certain areas is limited. The British, and the Japanese as well, have an overwhelming cruiser strength. We are not able fully to utilize our great destroyer strength due to lack of destroyer leaders. Our submarines are mostly all of pre-war design and do not equal in strength or cruising ability the up-to-date Japanese force.

The fighting strength of a fleet depends to a great extent on the relation of the various types to the whole. Unless sufficiently strong in all types, a fleet will not be an efficient force and will not be able to exert the maximum strength of which it should be capable. Our present fleet is not only relatively, but actually, deficient in light cruisers, destroyer leaders, and modern submarines. These individual weaknesses lessen the strength of the whole fleet by throwing it out of balance in respect to types so that its strength is not the same as that indicated by its aggregate size and standardized tonnage in capital ships.

TO be adequate, also, a fleet must, besides being balanced, be strong enough as a whole to fulfill its normal mission of supporting the country's policies and successfully to defend it and its possessions from attack. To accomplish these purposes with our standardized capital ship strength, experience, maneuvers, and study have indicated that a large tonnage of cruisers and of destroyers, including leaders, and a large number of submarines are needed to equip our battle fleet properly. These essential auxiliaries would furnish some protection for our commerce—which is fully as extensive and as important for us as for any other power—and would afford some assurance of protection to our interests in the Carribbean and in the Pacific as far as Hawaii. Such a force would not furnish adequate protection to our possessions in the Far East or insure their continued possession by us nor would it overcome existing base deficiencies, but it would make our fleet an effective, efficient organization and a substantial insurance against war in the future.

THE GREATEST WAR VESSEL EVER BUILT

The British battle cruiser Hood. *It is large enough to combine the high speed of a light cruiser with the gun-power and protection of a heavily armored battle-ship. Its displacement is 41,200 tons, more than 7000 tons larger than any that may now be built under the treaty*

"Movie" Film as Aid to Banking

THE Recordak is a machine designed primarily for bank use, and supplies the institution in which it is operated with a photographic record of all checks cashed or deposited. It is adapted to be used with any standard adding machine, its co-operation being automatic. Photographs are made as the checks are listed. It will make one picture of each check as they are passed through, or two pictures at the same time—these pictures being on different rolls of film.

Sixteen thousand checks are accommodated on a roll of safety film 16 millimeters wide and 200 feet long. By photographing the block numbers or file letters ahead of the checks, classification is made easy, and locating the facsimile of any particular check becomes a simple matter. An exact size image of any check concerning which there may be an inquiry can be examined by projection on a small screen, or any enlargement may be printed in case a copy is necessary.

There are occasions when the ability to produce a facsimile of a cancelled check protects the bank against attempted fraud. Often-times also, the depositor has lost his voucher or is handicapped by a poor memory. Although the bookkeeper's entries show that the check in question has been cashed, the case is closed when an image of the cancelled check itself appears on the screen.

Although customer's checks are held only until the monthly statements go out, the photographic record may be filed permanently in a comparatively small space. A 100-foot roll of film occupies three and three-fourths by three and three-fourths by three-fourths inches, and in this space copies of 8000 checks are filed.

The device operates independently of, or in connection with, an adding machine. A double camera takes two pictures of each check, exposing parallel strips of film. These two originals provide a copy for the bank's files, and a record to accompany checks sent to out-of-town banks for collection. One camera may be operated alone if desired.

Seated at the adding machine, the operator drops each check, as it is listed, into a hopper on the machine. Touching the space-bar of the adding machine operates the Recordak as well. As checks are photographed, they are collected in a receptacle in their original order.

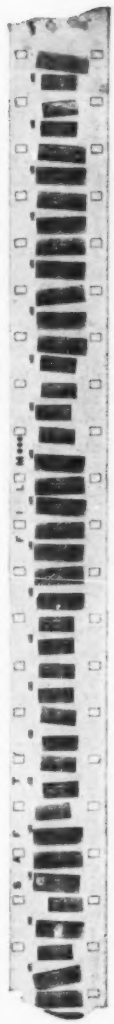
The camera is daylight loading and the exposed film may be removed at the close of business each day. The exposed film is processed and returned to the bank next morning, ready for projection. The cost is only one cent for each thirty checks photographed. Thousands of these copies of checks may be filed in the space occupied by a few of the originals. One large New York bank figures that the saving by this device is 12,500 dollars a year. The Eastman Kodak Company manufactures this unique business time saver.

A NEW AID TO BANKING

The "Recordak" is a machine for recording checks photographically on a celluloid film

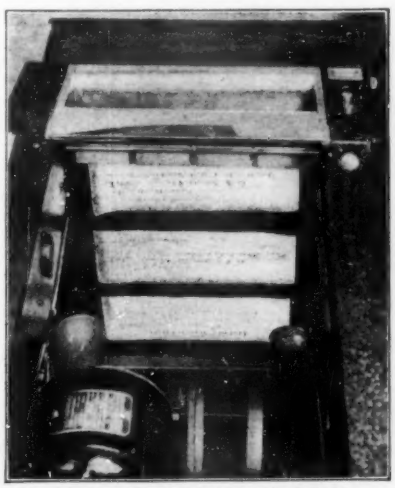
READY FOR ADDING MACHINE

The adding machine goes on the right. The adding machine button actuates the device



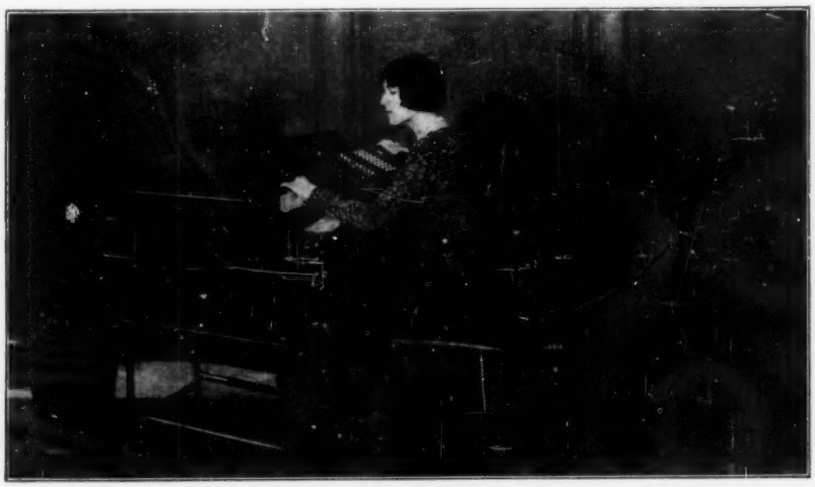
FILMED CHECKS ➤

Sixteen thousand checks can be filmed on a two hundred foot reel. By photographing dates or file letters, classification is easy. Frames are examined with a projector



CHECKS FACING THE LENS

Checks fed into a hopper are held on a curtain while two cameras expose films



THE MACHINE IN OPERATION

Seated at the adding machine the operator drops each check as it is listed into a hopper. Eighty-five checks can be photographed in one minute by the device described in detail above

The Month In Medical Science

A Review and Commentary on Progress in the Medical and Surgical Fields

By MORRIS FISHBEIN, M. D.
Editor of the Journal of the American Medical Association *and of* Hygeia

Vitamin B Deficiency In Infants

IN the Philippines, in Japan and in many tropical countries, beriberi develops because of the lack of vitamin B in the diet. Economic conditions force expectant or nursing mothers to live almost entirely on polished rice, and the infant fails to get its necessary quota of vitamin B, which is found in the unpolished rice. When vitamin B is absent from the diet, the most conspicious symptoms are associated with the nervous system and they are so diffuse in character as to give the condition the name of polyneuritis. Infants with this disease are restless and fretful, pale and waxy in appearance, cry with a whining, feeble cry, have frequent attacks of colicky pain, and suffer with twitching of the face, rigidity of the neck, and even with convulsions.

Similar symptoms are, of course, not infrequently seen in this country, associated with infections and with inflammations of the brain. Dr. B. R. Hoobler of Detroit believes that not infrequently American infants are also given diets which are deficient in vitamin B. The usual diet of infants in the United States, up to the third month, consists of human milk or cow's milk, to which has been added sugar or syrup, and possibly milled cereals, with some orange juice and cod-liver oil. Such a diet is plentifully supplied with vitamins A, C and D, but vitamin B is present only in the milk and in the orange juice and in limited amounts.

In his investigations, Doctor Hoobler supplied additional quantities of vitamin B to infants in the form of concentrates from brewer's yeast. It is his belief that every infant should have an addition of vitamin B to its formula and should not depend on milk, either human or cow's milk, as its only source of this vitamin. Experiments are now being made in the feeding of infants with added vitamin B with a view to determining whether or not the child's health and growth will not improve under such a regimen.

Denicotinized Tobacco

FOR some years the anti-tobacco organizations have waged such a persistent campaign against the weed that a market has developed for preparations of tobacco without nicotine. In their campaign, the adherents of the anti-tobacco movement have concentrated on nicotine as the most menacing ingredient in tobacco, notwithstanding the fact that tobacco smoke includes as well carbon monoxid, various sulphides, methyl alcohol, hydrocyanic acid, and many other substances that may be poisonous if taken in sufficient quantities. There are today dozens of denicotinized tobaccos and tobacco products on the market.

Chemical experts of the Connecticut Agricultural Experiment Station have recently made available their study of these preparations. The nicotine in tobacco varies from 2.5 to 3.5 percent for Virginia tobacco, 2 to 3 percent for various other domestic leaf tobaccoes, 1.1 to 2.4 percent for Havana, and 1 to 1.5 percent for Turkish tobaccos. Just as the ordinary tobaccos vary in their nicotine content, so also do the denicotinized products.

As a rule, these contain somewhat less nicotine than the tobacco leaf from which they are prepared. However, the lowest nicotine content found in any sample examined was about 0.75 percent, whereas some samples of ordinary tobacco may be as low as 0.50. Certainly many types of ordinary tobacco contain normally as little as 1 percent of nicotine. It is therefore obvious that no denicotinized tobacco has sufficient nicotine removed to warrant unrestricted indulgence on the part of the consumer.

It might be possible to remove nicotine completely, but chemical processes involved might at the same time utterly ruin it for any pleasurable effects from smoking. One of the difficulties of denicotinized preparations is that the consumer is likely to smoke far more, believing them to be without harm. In this way he gets nearly as much nicotine as if he did his usual amount of smoking with untreated tobacco, and at the same time far larger doses of the other constituents that have been mentioned.

Multiple Fingers

REGARDLESS of the fact that the condition occurs so frequently, all cases of multiple fingers and toes have interest. Dr. D. P. Penhallow recently described a case in which there was complete absence of the thumbs on each hand, each thumb being replaced by two complete fingers. In most of

MULTIPLE FINGERS

A dorsal view of the hands showing absence of thumbs, and the replacement of them by two complete digits. X-ray photograph of hands appears at the right

X-RAY OF MULTIPLE FINGERS

This view shows clearly the complete digital formation. The extra metacarpals and phalanges are perfectly formed

the cases that have been described, heredity played a part, but in the present case, which concerns a colored laborer 50 years of age, it was impossible to obtain a record of a similar instance in his ancestry. As shown in the pictures, in the place of each thumb there were two completely formed fingers resembling the third and fourth fingers. The right foot of the man was normal, but on the left foot there was a double great toe.

Mongolian Idiocy

SCIENTIFIC men recognize three grades of mental defectiveness—feeble mindedness, imbecility, and idiocy. It is possible to educate the feeble minded to the point where they may contribute their efforts toward self-support. The imbecile is uneducatable but can at least, in some instances, attend to himself. The idiot is so profoundly defective that his condition is practically hopeless. According to the Binet-Simon intelligence scale, persons who have a mental age of seven to twelve years are morons; those with a mental age between three and seven are imbeciles, and those who have not progressed beyond the age of three mentally are idiots.

One of the most peculiar forms of idiocy is that called mongolism. According to a view recently expressed by W. M. Van der Scheer, Mongolian idiocy is due to the effects of degenerative processes in the ovum before the child is born. The Mongolian idiot is marked by abnormalities of the face, jaws, nose, and eyes, which give it a Chinese or Oriental appearance. After the birth, other degenerative changes take place which seem to be due to the failure of adequate development of the brain.

SUPERNUMERARY PHALANGES

This X-ray photograph is of the left foot shown in the center of the second column

Many explanations have been advanced as to the nature of the process that attacks the infant before birth. Glandular processes and syphilis have been alleged to be primarily responsible. On the other hand some investigators assert definitely that the changes are atavistic and represent an attempt to return to early stages in human evolution. Some observers have asserted that the Mongolian idiot is always the last of a long series of births, others that it results from the fact that the mother may be too old at the time the child is born. Actually the scientific evidence is not sufficient to support either of these conceptions.

Round Worms in the Human Body

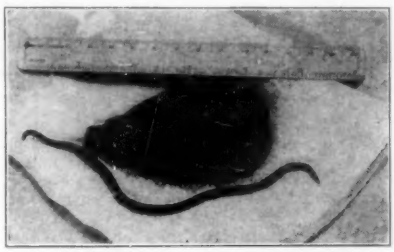
THE ascaris or round worm is an unusual but not an infrequent inhabitant of the human body. The ascaris, as shown in the illustration, is a round worm of which the male is 15 to 25 centimeters in length and 3 millimeters thick. The female is 20 to 40 centimeters long and 5 millimeters thick. It is strongly muscular and can wriggle with strong contractions. Its eggs are laid in the intestines of the human body and are spread by passage from the intestines so that they may contaminate food, drinking water, or be carried directly by the hands. It has been shown that the larvæ wander through the human body before settling down to develop.

EXTRA TO

In this curious case, the right foot is normal, but on the left is a bifurcated big toe

Large masses of these worms have been found obstructing the intestines, so that surgical operation was necessary for their removal. It has been noted that they tend to be vomited from the body in times of crisis in disease, or just before death.

A recent report by Dr. C. B. Morton collects a considerable number of cases in which this worm had developed in the gall-bladder. The problem that puzzles the surgeon is how this worm gets into the gall-bladder. One must assume that the egg hatches out in the gall-bladder or that a small worm migrates from the intestines through the tiny passage that carries the bile from the gall-bladder to the intestines. Another case has occurred in which a tapeworm ten feet long was found in the gall-bladder. Seven cases have been reported of the finding of round worms in the gall-bladder. In the case seen by Doctor Morton, the patient was a woman 45 years of age who had suffered repeatedly with pains in the abdomen in the region of the gall-bladder. The only indication that a worm inhabitant was present in her gall-bladder came out after the operation when careful questioning revealed the fact that the patient was nauseated and vomited a round worm 15 centimeters long the day before the operation.



WORM AND GALL BLADDER

In the report starting at the left, several instances of worms in the human body are cited. The photograph shows an ascaris and the gall-bladder of a human being from which it was removed after an operation

The Washing of Tin Cans

AN examination made of unwashed cans in New England canneries revealed bacterial counts as high as 162,000 per can. Indeed, cans just out of the machine contained a considerable number of bacteria, although not so many as in those which had stood for some time.

In the modern process of canning, the can with the food inside is subjected to high temperature under pressure for a considerable period of time. The amount of time necessary and the temperature required have been calculated on the basis of the possible bacterial contamination. If, however, the cans contain an unduly large number of bacteria previous to the sterilization, it is unreasonable to expect that all of the germs will be destroyed. For this reason, the canning industry has made a special study of the possibilities from the unwashed can and at least one group of manufacturers, the fish canning industry of the Pacific Coast, has gone on record as advocating the use of all washed cans as an additional sanitary measure and safeguard to the food supply.

The housewife who does her own canning will realize the importance of thorough washing, indeed actual boiling, of jars and tin cans before they are used for packing purposes. This is particularly desirable when empty fruit jars are held over for use year after year.

THREE DRIED SEEDS

When detached, the awns (tails) will dry and curl in a few minutes

The Brace and Bit Plant

The Seed of the Bizarre Colorado Grass Automatically Bores Its Way Deep Into the Soil

By OLIVER B. FINN, A.B., A.M., M.E.
With Drawings by the Author

DID you ever notice a carpenter or an electrician boring a hole somewhere about the house, close to a wall or in a corner where he could not turn the auger completely around and had to turn it back and forth? This he does with a ratchet brace and bit—really a very ingenious and intricate mechanism. The fellow who first thought it out did some tall thinking, but "why should the spirit of mortal be proud?"—this article tells of a lowly plant, a mere blade of grass, that had this ratchet brace and bit all figured out and put to good use long before man existed.

The "brace and bit plant" belongs to the geranium or crane's-bill family. The seed pod looks like a crane's bill because of the long stems attached to the seed, several of which grow bunched together.

That the seeds of some plants bury themselves has been known to students of botany for a long time, but there seems to be no record of the true interpretation of how this curious feat is accomplished. The mechanism with which nature has supplied these seeds is a veritable counterpart of the ratchet brace and bit, except that it is an improvement on it in two respects: it is automatic, and the bit will bore when turned in either direction. By means of this versatile mechanism the seed is buried several inches below the surface of the ground, evidently to protect it against heat and drought.

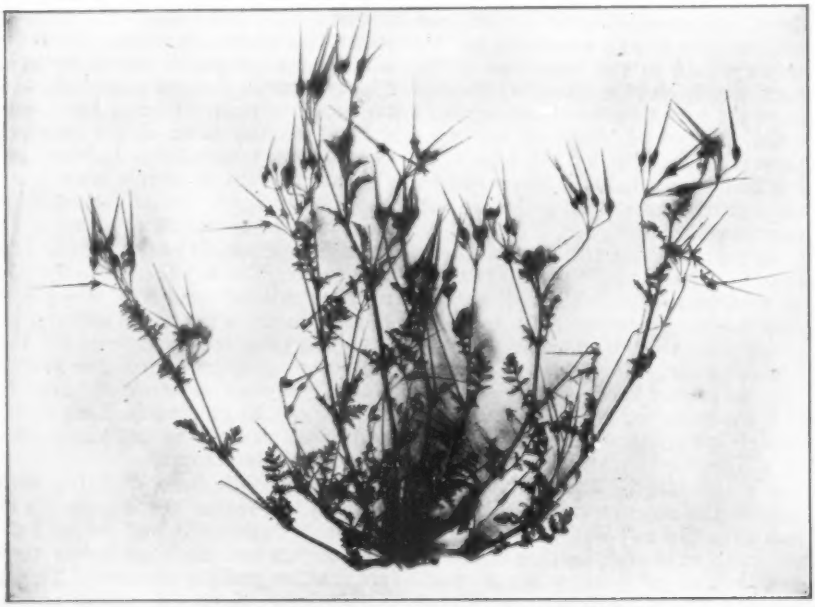
A CASUAL observation of the peculiar plant leaves the impression that its seed appendages are simply a form of burr designed to insure them wide distribution. The seed with its appendage, when fresh from the plant, looks like a small spear about three or four inches long. If one holds the head of the spear stationary, the opposite end for about one fourth of its length will soon be observed to bend slowly over, until it is at right angles to the remainder of the stem, and will become slightly curved like a sickle. Then this end, like the hand of a clock, begins to go around, and will continue to move for several minutes, until the main stem is twisted spirally from end to end like an auger, and until it becomes perfectly dry. If it is now moistened it will unwind, turning in the reverse direction until it is again saturated with moisture.

THE discovery of this life-like power of movement prompted an investigation, for it was reasoned that it must have some relation to the economy of the plant. Although great numbers of the dried twisted seeds were found on the surface of the ground, under the plants which grew them, a closer search revealed many of the seeds having only the bent-over ends projecting above the surface. Upon digging the soil away from these, the main stem was found with the spear-like head containing the seeds proper at its lower end. Some of the seeds had actually reached a depth of four and five inches.

Nature's Unpatented Invention

ERODIUM is the scientific name of the "brace and bit" plant. It belongs to the group which includes the common geranium. In all there are some 65 species of *erodium*, chiefly confined to the western states. The author of the accompanying article kindly sent the editor a sample of the plant and as a result, not much work was accomplished in the editorial rooms during the remainder of the day—so much fun was had playing with the little seeds or carpels whose antics are not at all exaggerated by the author. Nature provides some odd wrinkles for distributing seeds.

The Editor.



THE BRACE AND BIT PLANT WITH ITS SEEDS

Each of the seed pods (stork's bill in appearance, hence the plant's name, "stork's bill") consists of several seeds with awns. When these are separated, the drying and curling process begins

An analysis of this remarkable mechanism reveals the following information: the stem or "awn" of the seed is hygroscopic, that is, it has the power of quickly absorbing moisture and as quickly drying. When moist the awn is straight, but when dry it is twisted like an auger. Rain, humid atmosphere or the dews, untwist the awn, while the succeeding warmth of the sun or dry air or soil twists it up again.

At the seed end of the awn there is a hard, sharp point fringed with short, flexible hairs that form a feather-like blade. These hairs have a double purpose. When the awn is twisting, the pressure of the soil on one side bends them over slightly and the resulting curved surface acts like that of a ship's propeller and drives the seed downward into the soil.

THIS is the result whichever direction the seed turns. The hairs on the seed end of the awn and the smaller ones throughout its length act like the barb on a fish hook, preventing the seed from moving backwards out of the ground, once it is driven into it.

The hairs and the sharp point to which they are attached form the "bit" of the "auger;" the bent over end of the awn forms the "ratchet;" and any blade of grass, stick or stone, acts as the "pawl," holding the ratchet stationary when, in twisting up, it presents its concave side, but allowing it to slip by when it reverses its direction in unwinding. When the "ratchet" is held still, the "bit" is compelled to turn and forces its way into the soil, but when the ratchet slips past the pawl the bit remains still, exactly as in the ratchet brace and bit. The lower end of the point is slightly curved so that when it twists around, it "breaks ground" for the full size of the seed to follow.

One of the plants which has this peculiar seed-preserving device grows in great abundance in California, and in the wet season furnishes rich grazing for cattle and sheep. In the dry season these pastures are baked hard and are devoid of any sign of vegetation. Deep down in the soil, however, the seed is waiting in safety for growing weather when it will be turned into most beautiful and luxuriant verdure.

The accompanying illustrations show the seed in the various stages of planting itself automatically.

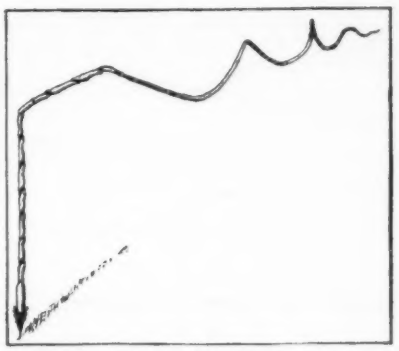
In some varieties there are additional appendages to the upper end of the awn. One found in Colorado has a long wire-like end which curls up like

THE BUSINESS END

The curved point bores somewhat on the cutting principle of the expansion bit

a corkscrew or straightens out again, according to the variations in amount of humidity. This gives the seed a greater reach, and therefore gives it a greater chance of using its boring power, which is ineffectual unless the ratchet comes in contact with something that acts as a pawl to hold it still. When this corkscrew-like end curls up, it presses against any overhead obstruction that it can reach and "braces" the bit, thus helping it to force its way into the ground.

One of these self-planting seeds, found in southern Europe, has a

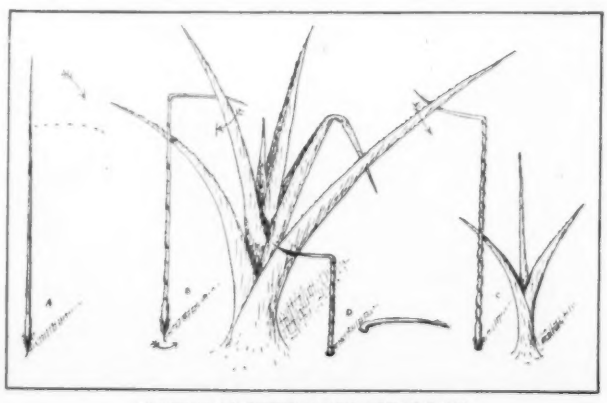


SEED AND POINT

Another genus of the same peculiar order of plants is called the "crane's bill"

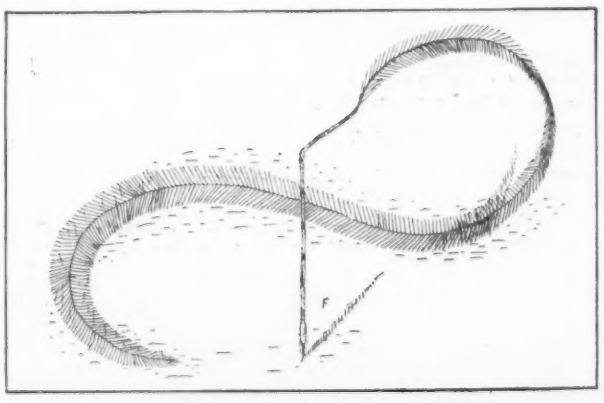
feather-like prolongation of the awn nearly a foot long, to which is ascribed the function of flight; that is, it is easily picked up by the wind and carried long distances from its parent plant, where it proceeds to bore into the ground. Botanists have attributed the power of self-planting simply to the downward push resulting from the bending over and straightening out of the end of the awn. This mechanism, with slight variations for adapting it to different conditions, is found in the seed of a number of plants which are in no way related to one another.

SOME of these seeds have long hairs which, when the seeds begin to twist, bristle out and prop them up so that they can get a start into the soil—very much as a gang of men will prop up a telegraph pole with long sticks in order to start it into the hole dug for it. These hairs also serve to catch and hold a drop of rain or dew, and as fast as it moistens and straightens out the awn, to push it up along the awn until the latter is completely untwisted, ready to dry and bore again—simulating a water elevator. Here is food for thought: A blade of grass with no thinking organs, achieving such a wonderful and economical use of its apparently useless parts.



HOW THE SEED DIGS ITSELF IN

At A *it has fallen; at* B *the awn is ratcheting against a blade of grass; at* C *(right) the awn, in reverse, is slipping past the pawl;* D *boring*



AN AIRBORNE EUROPEAN RELATIVE

Stipa pennata *is the name of this grass from southern Europe whose awn is long enough (12 inches) to permit flight before boring in*

DOWN THE HUMP

Classification tracks seen from the hump. The cars go down by gravity, are shunted to the proper tracks by electrical switches, and are slowed down by retarders like that shown in circle

Speeding Up a Railroad Yard

Automatic Switching Equipment Takes the Place of Yardmen for Sorting Cars in a Freight Terminal

By JAMES R. RANDOLPH

FREIGHT cars have to change trains, the same as passengers do. At some point in their journey they have to be sorted, and regrouped into trains bound for their destinations or the divisions on which their destinations lie.

To do this sorting is the business of a classification yard, such as the one at Mechanicville, New York, which forms the western gateway to the Boston and Maine Railroad, and the territory lying to the east of it. To this yard come freight trains from the west and the south, and here they are broken up and made into trains for the various terminals throughout northern New England. Local freights, including cars for the small towns and factory sidings on some of the divisions, are also made up here. These cars have to be arranged in the order in which they are to be dropped off, so that those for each siding will be in the most convenient place in the train when that siding is reached.

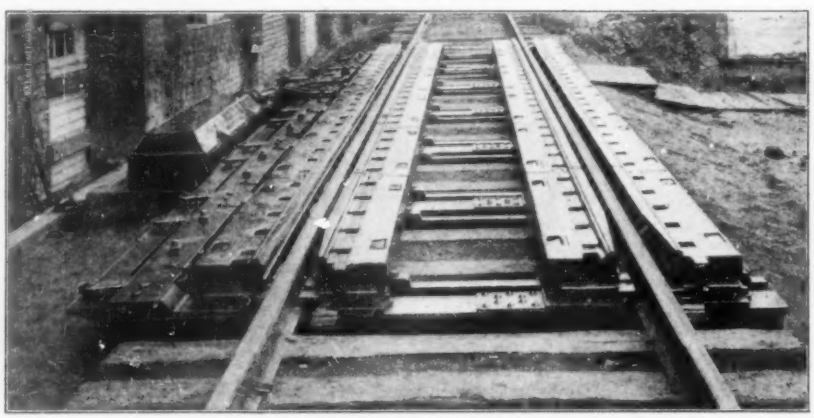
THE method of sorting in this yard is to push the train over a hump, from which all the classification tracks spread out fan-like down grade. Here the cars are uncoupled in "cuts" of one or more cars destined for the same track, and go down to their tracks by gravity. Formerly each cut was ridden by a yardman who applied the brakes to control speed. In bad weather, however, this work was hard and dangerous, and at all times a large crew of men was required.

Within recent months the Mechanicville yard has been made over with new grades, new tracks, and the latest modern devices to facilitate the work. The riders on the cuts and the men at the switches are now a thing of the past. The cars are switched to the proper tracks and their speed is controlled by small levers operated by men seated in comfortable towers.

The new yard was officially opened recently by President Hannauer and other Boston and Maine officials, in the presence of prominent visitors from New York and New England.

With its new equipment the yard has proved able to sort cars and place them in the outgoing trains in less than half the time previously necessary. As a result, hours of time are saved in the delivery of freight. This is especially valuable in handling perishable freight, of which a great deal goes to New England.

WITH one man in each of the two control towers, the yard can handle 150 cars per hour. The towers are equipped for duplicate control, and



FOR RETARDING THE CARS

A close-up of a retarder. Electrically operated springs beneath the rail draw the steel shoes together so that they squeeze the flanges and outer rims of car wheels in order to slow down a car

with two men in each, 250 cars per hour can be handled.

Experience has shown so far that damage to cars and contents that sometimes occurs with the old hand control methods has been eliminated. Danger to men has been done away with.

Chief of the features of the new yard are the car retarders, of which President Hannauer is co-inventor and of which there are 17 in the yard. They are so placed that cars may be run down from the hump at a moderate speed and then slowed down before reaching the classification tracks to a speed of three or four miles per hour, at which speed they can couple without damage to cars that are standing on the tracks.

EACH retarder has several pairs of heavy steel shoes, the shoes of a pair being opposite each other on each side of the rail. Springs beneath the rail draw the shoes together with a tension that may be varied by electric control from the tower. The retarders are set according to the weight of the car and the change of speed desired. The switches are also controlled electrically from the tower.

In other ways, also, the yard is well equipped. When a train arrives on one of the tracks in the receiving yard the conductor sends his way bills through a pneumatic tube to the yard office. From them the yard clerk makes out the switching list, giving car initial and number, weight, classification track, and destination.

This list is written on a teletype, or electric typewriter, which makes four copies at once—one in the yard office, one in the hump cabin, and one in each of the two towers. Thus each operator is told just what to do with each car in the train. Formerly each of a number of switchmen had to have a carbon copy of this list, and much time was required to reach each individual.

THE HUMP CABIN

Operators in this cabin keep a record of the cars as they start rolling down the incline

As the train is pushed upon the hump, the hump conductor notifies the tower man which train is coming, and gives any special instructions that may be needed. These are given over a telephone equipped with loud speakers at both ends so that there is no bother in getting a connection.

AT night the yard is well lighted with flood lights. The hump signal, which is repeated at three points, has four colored lights with which to signal the engineman how to handle the train. This signal is repeated in the first tower, and the towerman there can set it to the stop position should he desire to do so. Klaxons are provided to supplement the lights in foggy weather. Provision is made for forcing hot oil into the journal boxes of the cars in cold weather so that the cars will always roll freely. Towers and hump cabin are at all times comfortably heated.

Because electricity plays such an important part in the operation of the yard, great care is taken to insure a continuous supply. Power is available from two outside sources, and the yard is equipped with storage batteries in case both sources should fail at once. These batteries may be charged from either source, and are sufficiently large to run the yard for several hours.

There are 10 tracks in the receiving yard, each long enough for a whole train. In the classification yard there are 36 tracks, with a total capacity of 1930 cars. At the lower end are six doubling-over leads, where six new trains can be put together without blocking each other's switching.

Beside the hump, on the north, is a transfer yard holding 237 cars, for freight that must be moved from one car to another. On the other side is a cripple yard, holding 240 cars, and provided with a car repair shop. Here, also, are cattle sheds for feeding live stock, and ice houses for re-icing refrigerator cars.

At the lower end of the yard are the roundhouse, the locomotive shop, cinder pits, and other equipment needed for the care of the motive power.

MECHANICVILLE is just north of Albany, on the western side of the Hudson River. There is a natural down grade in the direction of freight movement, and this has been regulated to meet the needs of the different parts of the yard. In the receiving yard this grade is 0.36 percent and it increases slightly in going down to the hump. On the western side of the hump there is a short up-grade to give slack for uncoupling, and then, on the eastern side, a down-grade reaching a maximum of 4 percent. This eases off as the switches are passed to a grade of one fourth of 1 percent, which continues throughout the yard. In the retarders the grade is steep enough to get the cars started in case they stop there.

ELECTRICAL SWITCHES

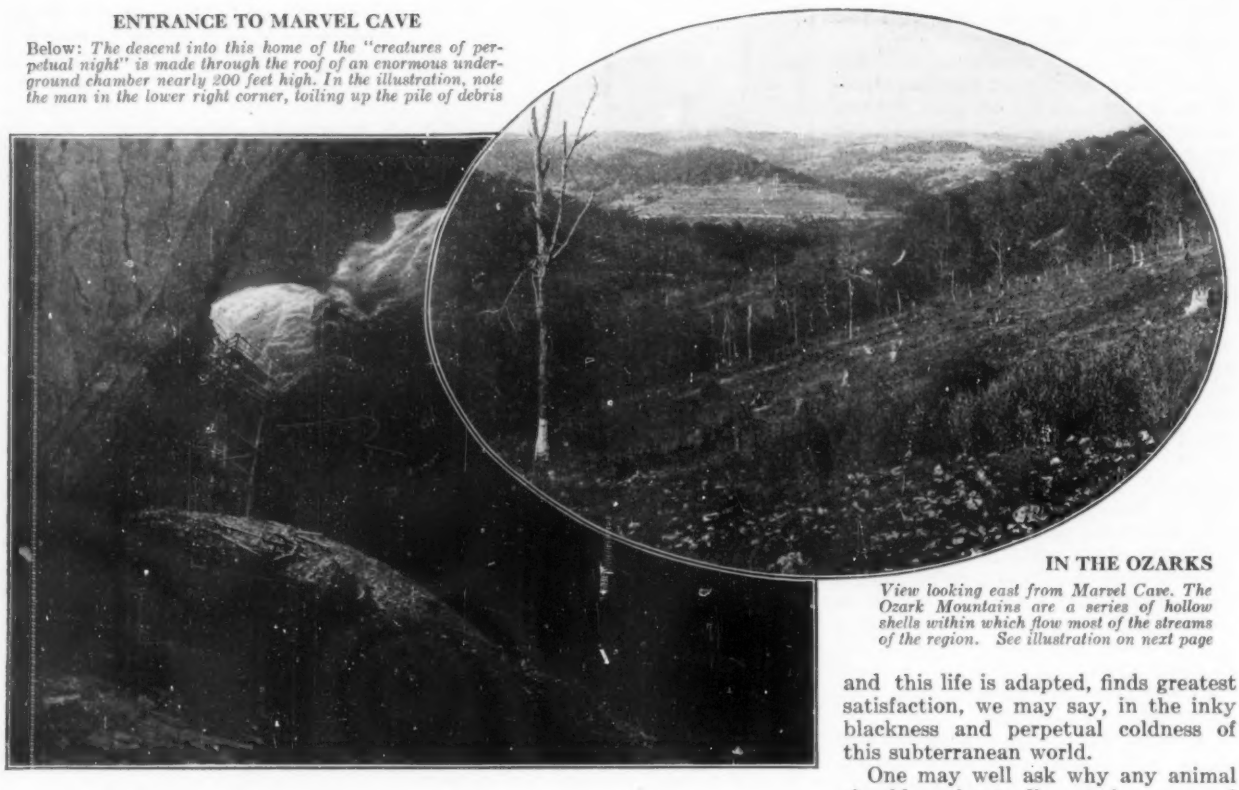
In the left background is the control tower from which the switches in the foreground are operated. In the center background is the hump

THE CONTROL BOARD

President Hannauer of the Boston and Maine at the switchboard in one of the towers. Levers operate the electrical switches and retarders

ENTRANCE TO MARVEL CAVE

Below: *The descent into this home of the "creatures of perpetual night" is made through the roof of an enormous underground chamber nearly 200 feet high. In the illustration, note the man in the lower right corner, toiling up the pile of debris*



IN THE OZARKS

View looking east from Marvel Cave. The Ozark Mountains are a series of hollow shells within which flow most of the streams of the region. *See illustration on next page*

Creatures of Perpetual Night

An Account of An Expedition to the Ozarks in Search of the Blind Salamander

By G. KINGSLEY NOBLE

Curator, Amphibians and Reptiles, American Museum of Natural History

FROM the Appalachians to the Rockies the vast plains of the continental interior extend some 1200 miles, the thick layers of sediment nearly as even and unwrinkled as when first laid down. From Carboniferous time when the beds of the Mississippi Valley were finally raised above the level of the shallow inland sea until today, the great basin which forms so large a part of the United States has remained a lowland, now rising, now sinking, but never oscillating far in either direction.

Only in the Ozark region have orogenic forces pushed up the beds of Paleozoic limestone into steep, rocky hills. Limestone is poor material with which to build great mountains. The rains soon smooth off all prominent features, and the water, acidified by the decaying vegetation of the slopes, seeps through the porous rock to carve for itself innumerable channels and chambers within the heart of the hills. The Ozarks, seamed and wrinkled, remain throughout most of the year a series of dry shells within which the subterranean waters flow for miles before bursting forth at the base of the hills to join the larger rivers of the lowlands.

THE devious passageways and water channels which honeycomb the Ozarks have always held a strange fascination for the hardy peoples who settled in southern Missouri and northern Arkansas. The more accessible caves, especially those rich in stalactites and stalagmites, were soon explored, but there remained dozens of other more extensive caves which seemed to defy the entrance of man. Yet into these crooked, winding passageways adventurers finally penetrated, and we now know that the heart of the Ozarks is not formed merely of cold, stony, dripping chambers. An abundance of life is present and this life is adapted, finds greatest satisfaction, we may say, in the inky blackness and perpetual coldness of this subterranean world.

One may well ask why any animal should prefer to live so far removed from the outer world. Naturalists for a century have asked this very question. And some of the most distinguished among them, such as E. D. Cope, have visited the Ozarks to gain better acquaintance with the cave fauna. Most cave animals are blind, their bodies white and ghostly translucent in the light of a torch. Many are equipped with a rich growth of sense papillæ, or bristles, with which they feel instead of see approaching enemies and prey.

WHAT have been the causes of these changes? Use and disuse, the older naturalists replied, but such an explanation does not receive any support from the vast amount of experimental data provided by modern biology. Hence, it seemed advisable to penetrate once more into the Ozark caves to determine more accurately the environmental factors and further to secure living material in sufficient quantity for an experimental analysis.

Most of the cave entrances in the Ozarks are far off the main highway, usually at the foot of some hill. As the roads generally follow the ridges, there was ample opportunity for me to get acquainted with the fauna of the outer world. The hills on closer acquaintance proved to be steep piles of small limestone chips among which there struggled a thick growth of deciduous woods. Descending a slope was like walking down a coal pile, the chips giving way at every step. In

such a terrain devoid of anything that can be called soil, moisture can remain but a short time, and as September had been a very dry month, the loose stones noisily announced our approach with a metallic clatter. The first to be frightened by the intruders was a blue-tailed skink which scurried away in the brush. Turning over adjacent logs we captured two others. This lizard and its close relative, the coal skink, we met very frequently in the hills. The slim-bodied skink was found in the same situations, and on the more exposed slopes we caught the collared lizard.

Our first descent into the lowlands revealed that snakes were far more abundant than in any other place I have visited. The most conspicuous was the mountain black snake, but the individuals we met were not like our New Jersey friends; they were flecked above with white, and blotched below with black. Here was an incipient species not yet sufficiently demarcated from its eastern relatives to be called a distinct race. On these arid slopes a dark coloration would seem entirely out of place, but all the racers we saw were handsomely clothed in satiny black. Copperheads, we soon discovered, were very common, and after we had captured our first, a few feet from the trail, the almost perfect concealing coloration of this serpent assumed for us a new interest.

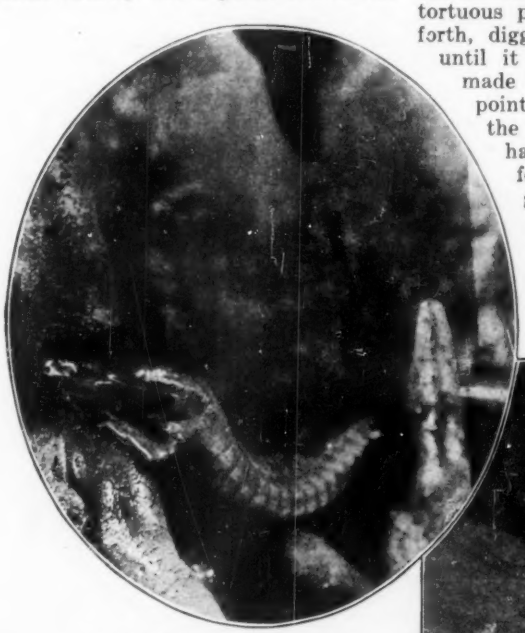
Only a very small part of the Ozark fauna seemed concealingly colored and a few creatures were obviously the reverse. One that thrust itself upon us from the first was that of the noisy "news bee," a fly which is colored exactly like a queen yellow jacket and has the form, color, and sound of the same unpleasant acquaintance. Here was an instance of mimicry, the fly supposedly gaining protection by this mummery. Natural selection working on a host of color varieties in an ancestral fly picked out this noisy yellow and black fellow, recognizing by this very act that bluff and noise will sometimes carry one a long way toward success.

THE entrance to Marvel Cave, the largest Missouri cave I explored, is through one of two openings in the roof of an enormous subterranean chamber nearly 200 feet high, 400 feet long, and 225 feet wide. A pile of stone debris forms a hill about 125 feet high under the openings and the descent to its summit is managed by a wooden stairway. The latter is maintained by Miss Genevieve Lynch, the owner of the cave, who for some years has opened the cave to visitors.

The few tourists who come to this little-known region follow a guide to the far end of the chamber where a tortuous passageway twists back and forth, digging deep into the ground until it reaches the water course made by Lost River. The lowest point of the journey is reached at the foot of the waterfall which has been determined as 480 feet below the surface of the ground. Throughout the long route followed by tourists, blind salamanders have never, in recent years, been seen. It was our plan to begin where the tourist turns back, namely, at the foot of the waterfall. A hole half way up a bank of soft red clay indicates the opening of the passageway to Blondie's Throne.

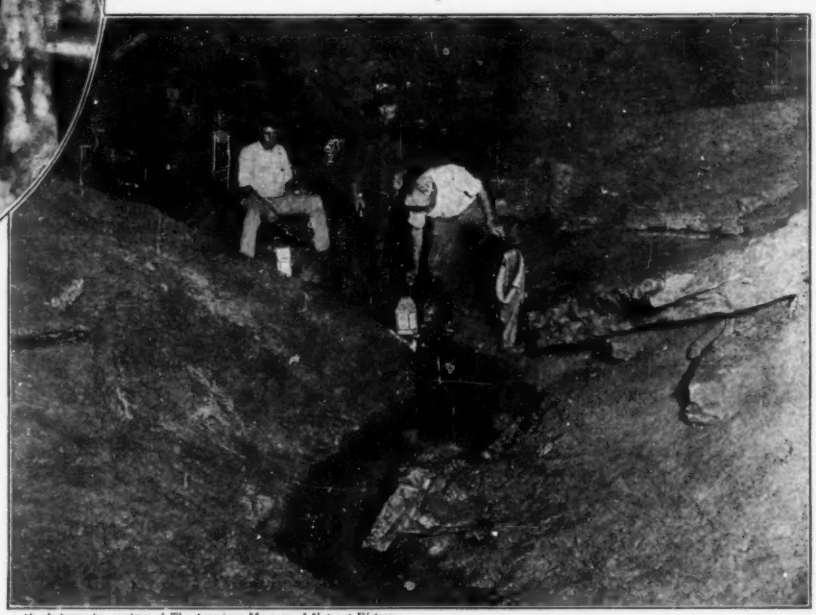
Previous experience had taught us that cave exploration is very wet, sticky work. One crawls or wallows forward in adhesive mud far more often than one ever stands. Our party consisted of Byron C. Marshall, a herpetologist of Arkansas, Clark Gallaher, head guide of Marvel Cave, and myself. The bank proved as soft as it looked, and we were all smeared with mud before we reached the entrance and began the long crawl. Marshall and I were armed with electric torches and collecting tins, while Gallaher managed a gasoline lantern, the first, no doubt, ever carried in this narrow passage.

BLONDIE'S THRONE is probably not more than 400 feet from the waterfall, but as much of the distance is covered flat on one's stomach, the trip required over an hour. The passageway probably averages two feet high and four broad. The mud of the waterfall room soon gives way to sheets of limestone and dripstone of colors varying from black to yellow. The floor of the passage is made anything but comfortable by a series of more or less connected pools containing water of 58 degrees, Fahrenheit. We dragged ourselves slowly through the water and found that life was abundant in this inky passage. A black gnat which we had seen in other caves was here in numbers, some black beetles were seen walking over the rocks, while the pools contained a colorless crustacean.



A BLIND SALAMANDER

This creature, Typhlotriton spelaeus, *was the goal of the expedition described here*



All photographs courtesy of The American Museum of Natural History

CATCHING A "GRAY GHOST"

The blind salamander, called the "gray ghost," frequents the edges of small underground streams and pools. The blind salamander of the Ozark region is terrestrial in its habits when full grown

RESTING

A stop between crawls is imperative because of the arduous nature of this mode of travel

We came upon our first blind salamander shortly after beginning the crawl. It was walking rapidly over the loose stones in an effort to escape. In the light of the gasoline lantern its pale tones gave it a most unreal appearance. The beast looked more like some creature fashioned out of dough than a living organism. Its dark eyeballs shone through the translucent lids and gave it a peculiar expression. But once the creature was in the collecting tin it appeared more animate.

WE reached Blondie's Throne without encountering any other salamanders. But the bats which dashed past us as we crawled frequently misjudged the distances and rudely brushed us with their wings. Blondie's Throne proved to be a great vault of gray dripstone. A crawl of ten feet up a bank of slippery clay brought us to the main entrance to the room. The ceiling, some forty feet overhead, seemed to swirl about in the bright gleam of our spot lights. The squeaking and the continuous rain of excrement disclosed that the "ceiling" was in fact in motion. Myriads of bats circled about overhead, the beating of their wings sounding like the rhythmic puffing of a distant locomotive.

The room is partly filled by a tremendous stalagmite or throne above which a canopy of stalactites gracefully droops. But the festoons of black drapery on either side of the throne soon began to flutter, and I realized that they were great masses of bats holding tightly to one another's backs. A closer inspection showed that thick rugs at the foot of the throne were sheets of reeking bat guano in which one sank half way to the knee. The odor was stifling, the noise bewildering, and yet the grandeur and magnitude of the throne room with its walls ornamented with dripstone held us spellbound. It was half an hour before we began our perilous descent to the stream bed.

Beyond Blondie's Throne the passageway grows even more difficult as the pools become more frequent and deeper. But here collecting began in earnest. We soon caught one blind salamander under a stone beside a pool, and another that tried to slide past us in the narrow passage. But

RETURNING WITH THE SPOILS

The explorer's burden consists of living blind salamanders packed in quantities of ice

most surprising was still another which, when we disturbed it at the edge of a pool, made straight up a sloping bank toward a hole under the roof of the passage. Thus, these creatures with their sightless eyes must have well defined routes of travel and escape. By frequently touching their snouts to the ground they are able to make considerable speed between the loose pieces of lime and dripstone which floor their passageways.

Later we made other trips to Blondie's Throne and to near-by caves, which presented equally difficult crawls. None of these was as successful as our first. The crawl farther up Mystic River almost ended in disaster. Just as our party were attempting one of the worst squeezes, a swarm of several thousand bats started through the same opening. The squeaking, fluttering hordes almost stifled John, our guide, who was in the lead. They crawled up his trouser legs and down the open neck of his shirt. When they began to pile up as a solid, squirming wall directly across the crevice, the thought of whether there was enough oxygen for all struck the members of the party at the same time, and without awaiting for further demonstration a retreat was at once begun.

IN transporting and handling our salamanders many problems presented themselves. The young, or larvæ, we discovered lived for several years outside of caves in the springs which were fed by the underground streams. In order to bring larvæ from the surrounding springs to our base camp at Marvel Cave we found it necessary to carry the containers on ice. Further, the larvæ shipped better in wet leaves than in water. All these facts were learned only with the sacrifice of life. By constant vigilance and care we have managed to bring several hundred larvæ alive back to New York, where they are now available for laboratory studies which we believe will throw further light on the importance of environmental versus hereditary factors in the origin of blindness and depigmentation in the cave salamander.

STARING WITH SIGHTLESS EYES

The blind crayfish, Cambarus setosus, is the color of bleached bone. Its eyes are rudimentary, but like other subterranean animals, its sense of touch is greatly refined. Its pincers are strong

Stocking Up An Expedition's Larders

Byrd's Three Ships, Bound For the Antarctic, Are Loaded With Necessities and Incidentals For a Long, Hard Trip

By V. I. COOPER

WHEN the Byrd Antarctic Expedition was organized, approximately 750,000 dollars had to be raised, partly in money, and to a certain extent in materials.

Some people and firms gave in dollars and cents, according to Sidney Greason, purchasing agent of the expedition; others, like Henry Ford, contributed equipment. The Maxwell Coffee House donated the expedition's coffee; the National Carbon Company, lamps; the Radio Coporation of America, radio equipment; the General Box Company, containers; and Swift and Company, 3500 pounds of butter, packed in six-pound hermetically sealed tins, coated with Dupont waterproof paint on both ends to insure that the butter will be kept air tight, not only in the Antarctic but through that tropic zone which all three ships of the expedition must pass on their long voyage from New York to Dunedin, New Zealand. Dunedin is the last port of call before the lonely trip begins across 2300 miles of the world's stormiest sea and iceberg-infested waters through which, at certain seasons, no vessel can progress at all, to the camp at Bay of Whales, Antarctica.

UNQUESTIONABLY, the Byrd Antarctic Expedition is more completely equipped than any that has attempted to explore the frozen wastes of either the north or south polar region in the past, chiefly because the man at the head of it, Commander Richard E. Byrd, knows that its entire success depends upon the maintenance of the welfare and health of 76 men throughout 18 months—perhaps more—filled with hardships that will try each member of the party to the very limit of human endurance.

One hundred percent physically fit at the start, the men of the expedition are to be kept that way, and every means of assuring this result has been employed. No contingency has been overlooked.

One of the first considerations, naturally, was food. The three ships of the expedition—*City of New York*, *Port Hunter*, and *Chelsea*—(renamed the *Eleanor Bolling* after Byrd's mother)—will carry, among other items, 4000 pounds of pork loins, 2000 pounds of fresh hams, two tons of smoked hams, three tons of bacon, one half ton each of lamb and mutton, one ton of veal, two tons of corned beef, one ton each of corned tongue and corned shoulders, five tons of beef, 3500 Golden West fowl from Iowa, and 1500 pounds of calves' livers packed in 10-pound tins and thoroughly frozen before being put into the *Port Hunter's* ice chambers, which will carry the bulk of the refrigerated supplies. This is probably the first time in expeditionary history that calves' livers have been included in the dietary, and this is so because of the high vitamin content. Even the lowly "red hot" will find its place on the Antarctic menu! One thousand pounds of frankfurters are in the refrigerator!

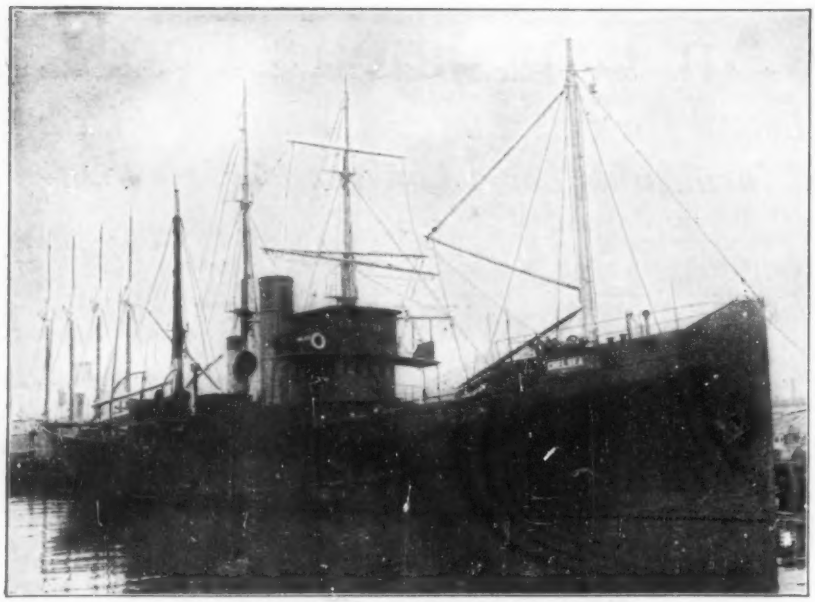
To name a few staple products, there are 10 tons of sugar, 200 cases of canned milk, 2000 pounds of dried milk, 50 gallons of lime cup, several cases of grape juice, nuts and raisins, and five tons of flour. The eggs, according to the present plan, will be bought in Dunedin, New Zealand. They must be sterile and unfertile, and the price in New Zealand is thought to be cheaper. Not once has Commander Byrd forgotten that the public is financing his expedition, and that its money must be conserved.

Each case of supplies is specially labeled to conserve time and energy. A few of the labels are:

Commissary—Red pennant
Medical—Red Cross

COMMANDER BYRD'S FLAG-SHIP

The ice-cutter, the City of New York, *formerly the* Samson, *which will be Byrd's headquarters. Over his desk in this ship will hang a photograph of Floyd Bennett, in tribute to his memory*



THE EXPEDITION'S AIRPLANE CARRIER

The former Chelsea, *renamed the* Eleanor Bolling *in honor of Commander Byrd's mother, which will carry the airplanes and the parts and machinery for their possible repair while in the Antarctic*

Flight—Arrow
Science—Triangle
Radio—Tower
Issue Expedition—Black ball
Ammunition—Red ball
Dog gear—Diamond

Fresh vegetables will be taken from New York—indeed, watermelons are aboard the *City of New York*—and other supplies will be taken on in Dunedin. Five thousand pounds of dried potatoes will be added there.

EVERY member of the expedition is to have turkey on Christmas day, with plenty of cranberry sauce, and there will be turkey on other holidays as well, because 2500 Maryland turkeys will go a long way. And while the "boys" are waiting for Christmas there is plenty of gum for them to chew—500 pounds—and countless cigarettes to smoke—1000 pounds each of cigarettes and tobacco.

There will be plenty to eat when the men set up housekeeping in the portable bungalows now aboard the *City of New York*, and if they experience a Vitamin B deficiency during the long, sunless winter months, they can spread their bread with Vitavose—a wheat germ product, that is both tonic and food, to supply the missing Vitamin. A large quantity of peanut butter, jams, and jellies donated by the Beechnut Company, is also a necessary adjunct.

In their spare moments—which will be happy moments—the men can play the piano, for there will be two in the camp at Bay of Whales, one of them an electric player, with a large number of rolls and sheet music. Or they can play whichever one they choose of the six guitars, 15 harmonicas, 12 ukeleles (one of the crew of the *City of New York* is Ukelele Dick, retired from the United States Navy), or the two xylophones, taken along in case hands should be too cold to play any other instrument. Music is the life of every party, even near the South Pole.

When the four men detailed to handle reports, transcribe technical data, file daily findings and check the expedition's supplies, and others of the party, grow tired of work in the office building, which is to be 12 feet wide by 15 feet long and is now in the hold of the *Eleanor Bolling*, and of their work elsewhere, they can play quoits, chess, checkers, baseball, or can box.

The expedition has been supplied with 20,000 sheets of a 100 percent rag paper of absolute permanence, and 40,000 sheets of a lower grade paper of lighter texture for carbon copies. This stock of paper was procured with the thought that records kept on the typewriter at the base camp will be in triplicate.

Scott, Amundsen, and Mawson, who spent some time in Antarctica, took only a few precious books with them. Commander Byrd, with that object in mind which prompted him to include pianos and xylophones and boxing gloves in the supplies, has assembled an extensive library for his associates.

THE actual selection of the books was left to Prof. Lawrence M. Gould, of the University of Michigan, a geologist with the expedition. He has tried to please everyone—scientists, shellbacks and even the Boy Scout! The books embrace science, fiction, poetry, philosophy and history, and number 2000, half of them the gift of David T. Layman, an attorney of New York City, the others purchased.

Fifty volumes of humor will make the quarters ring with laughter; six Zane Grey thrillers will fill the air with the aroma of the sage brush; and four Rex Beach novels will recall Alaska. Jules Verne's "Twenty Thousand Leagues Under the Sea" will remind the explorers that nothing in this world is impossible, and "The Vicar of Wakefield" by Oliver Goldsmith, will take the reader back to school days. Scott, Conrad, Pierre Loti, Joseph Lincoln, Romain Rolland,

THE LIFE OF THE PARTY

Far-sighted Commander Byrd believes in keeping up the morale of the personnel and, accordingly, included in his equipment musical instruments, books, games, and above all, good mattresses

Robert Louis Stevenson, Swift, and Mary Roberts Rinehart—all will be there.

Men who like to speculate while smoking will enjoy Nietzsche's "Thus Spake Zarathustra" and Santayana's "Essays," while those who know nothing of the long and interesting history of philosophy will learn the story from Will Durant's "Outline of Philosophy."

The continent wearing the South Pole in its button hole has been termed the "home of the blizzard" by Mawson, because most of the time the man in the open has to lean upon the wind at angles of 30 degrees to 45 degrees and even more—a wind that is seldom weaker than a hurricane. During the long winter months when nothing much can be done outside and the sun does not shine, there will be games for everyone to play, and books to read. Adventurers looking for the ghosts of Sherlock Holmes and Lupin, may see them when the wind howls in this most desolate region of the world.

SO that the explorers may protect themselves when they have to face this freezing wind—for every day some must go out to take meterologic readings, and so forth—100 pounds of odorless lanoline are included in the stores. Hands and faces will be smeared with this just as swimmers smear their bodies before entering the water for a long swim. Odorless lanoline was chosen because if it had a sheep's-wool smell, it would be very unpleasant.

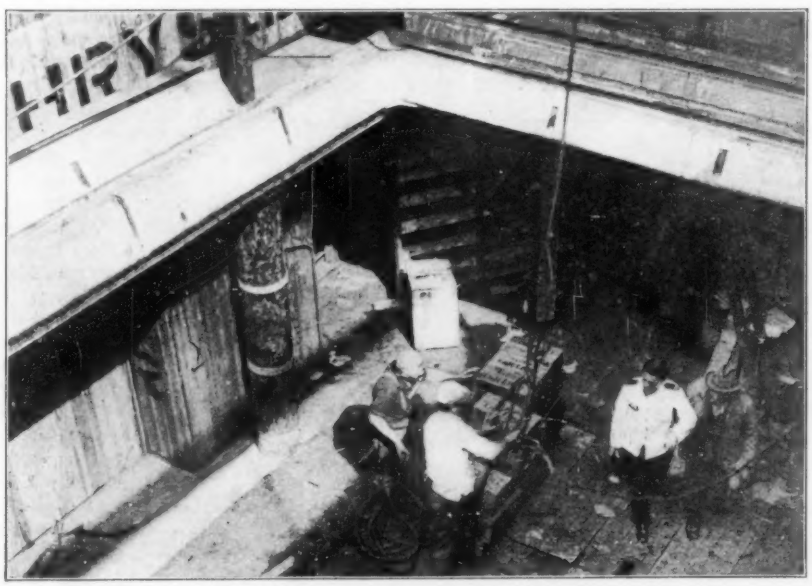
When Commander Byrd bought the 47-year-old *City of New York*, (a stout little ship formerly called the *Samson*) he found her original supply of medicine aboard! This would never do! So he told Dr. Francis Coman, of Johns Hopkins University, the Chief Medical Officer of the expedition, to assume the responsibility of providing, in advance, a stock of medical stores to cope with the almost unknown requirements of the party over a period of at least 18 months.

A single omission—an oversight in packing—might result in the death of one or a dozen members of the expedition, because once New Zealand is left behind, the last possibility of replenishment fades.

So Doctor Coman, with the cooperation of Dr. John F. Anderson, formerly Director of the Hygienic Laboratories, United States Public Health Service, and now Director of the Squibb Biological Laboratories at New Brunswick, New Jersey, put on his thinking cap and went to work.

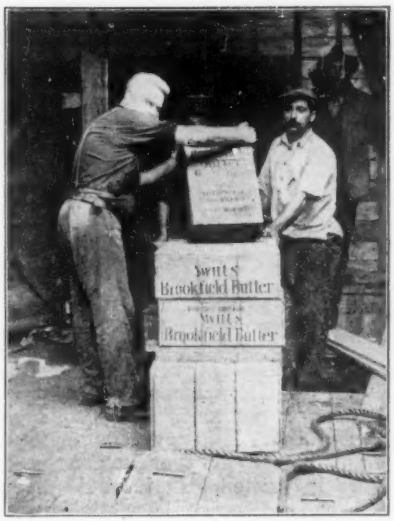
AND CHICKENS!

Lieut. Comdr. Melville taking the temperature of frozen chickens before loading them



VITAMINS FOR THE PERSONNEL

Calves' livers, previously frozen and packed in 10-pound tins, being placed in the ice-chamber of the Port Hunter. *Commander Byrd wanted to be sure no one suffered a vitamin deficiency*



THEY CAN HAVE TOAST

At any rate, here is the butter being loaded into the refrigerator of the supply ship

The two men assembled a stock of medical stores which, from the viewpoint of therapeutic excellence and completeness, has never been equaled by that of any other similar undertaking, capable of coping with everything from a scratch to the debilitating effects of a want of sunshine.

In assembling the supplies for the "sick-bay" of the mother ship and the "drug store" of the camp at the Bay of Whales, many factors were taken into consideration, and not the least of these was the possibility of running into natives in isolated villages who might be ill and direly in need of medical attention. From beginning to end, the expedition has been planned along humanitarian lines.

AT the time of departure from New York city, every member of the party will have been immunized against typhoid and small-pox. Additional vaccine is in the medicine chest for emergencies, and 200 packages of tetanus antitoxin are at the doctors' finger tips to immunize every cut, immediately. There are several hundred packages of diphtheria antitoxin in the locker, as well as Solargentum and Novargentum, germicidals, and cod-liver oil, castor oil, epsom salts, and—last but far from least—corn collodion for the comfort of the heavily shod feet of the explorers.

A large supply of ether (450 pounds, enough for 1300 operations) has been included for anesthesia. It is more than is anticipated will be used for the personnel, but the leaders of the expedition feel certain that at some time or other, in their long stay in the Antarctic region, they will run across numerous cases whose suffering can be relieved by an operation. Every aid known to medical science will be rendered all who may be taken sick.

Did Old Stone Age Man Inhabit Ireland?

New Evidence, Adding a Chapter to Irish Pre-history, Is Hotly Contested by Irish Anthropologists

By J. REID MOIR

Fellow of the Royal Anthropological Institute of Great Britain and Ireland
Member, L'Institut International D'Anthropologie
Vice-President, Suffolk Institute of Archeology and Natural History

Drawings by the Author

AS readers of the SCIENTIFIC AMERICAN are well aware, there is at present considerable activity among archeologists in tracing out ancient man's history in England. It is now becoming generally recognized that human beings were in existence in East Anglia so long ago as Pliocene times, while during the warm interludes of the Great Ice Age which was regarded hitherto as one and indivisible, it is now known that Paleolithic man inhabited the country.

The recognition of these facts is resulting in a very drastic change in our view as to the antiquity and dispersion of the Paleolithic peoples, and while at one time, these were supposed to have lived in southeastern England in post-glacial times, about 100,000 years ago, we know now that the makers of the paleoliths roamed far and wide over the country in inter-glacial times and that the earliest of them existed perhaps 500,000 years in the past.

BUT although this is the case, it was with considerable surprise that scientific people received the announcement, made towards the close of 1927, that definite traces of Lower Paleolithic man had been found upon the coast of Sligo in northwest Ireland. There are, in fact, few places to which the average archeologist would be least likely to turn in search of such traces than to this part of Ireland, for it has been taught for many years that during the whole of the period during which Paleolithic man lived in southern England, most of Ireland, especially the northern part, was covered by an immense ice sheet which prevented the existence of man in that area.

It is, however, of interest to note that apart from the evidence to be set forth in this article, there have been found at various places in Ireland, supposedly covered by the above mentioned ice sheet, the fossil bones of extinct animals such as were associated with Paleolithic man in England. Thus it is clear that the ancient fauna reached Ireland by land routes now submerged beneath the Irish Sea, and it is only reasonable to suppose that where the animals could go man could follow. The fossil bones were found in deposits of unquestioned antiquity, but it is to be regretted that at the time of their discovery no search was made for the stone implements likely to be associated with them.

During the summer of last year, my friend Mr. J. P. T. Burchell, a very keen and thorough archeologist, was spending a holiday upon the Irish coast, and while there he found at various sites a series of implements made of limestone, to which he quickly drew my attention. The place where he first found some of these specimens is at Coney Island off the Sligo coast, where, upon the shore, there were recovered a number of artifacts in a somewhat rolled condition. From Figure 1, a very good idea can be formed of the wild beauty of the Sligo coast with its hard limestone rock fretted by the sea, and covered a little inland by deposits of glacial boulder clay and other accumulations.

When I examined the Coney Island specimens I at once recognized their human origin and the fact that they compared in their forms and flaking with the implements and flakes of known early Mousterian date. But, as the artifacts had been found lying upon the open shore, and therefore not assignable to any definite geological age, I urged Mr. Burchell to search for similar specimens elsewhere where the necessary conditions would be fulfilled.

IN the course of these researches he came upon a remarkable site upon the mainland at Rosses Point, where under a mass of rocks were found over 100 unrolled limestone implements and flakes of the same type previously discovered on Coney Island. The Rosses Point site is shown in Figure 2 and gives a very good idea of the blocks of limestone beneath which, and lying upon the basal platform of rock, the artifacts were recovered.

If an examination is made of Figure 2, it will be seen that facing the observer is a low wall of limestone *in situ*. The discovery of a large series of

THE WILD SLIGO COAST AT BALLYCONNELL

Figure 1: *The hard limestone rocks are perpetually washed by seas that roll in from the Atlantic. High up on the right is a deposit or cap of glacial boulder clay in which two of the artifacts described in the article were recovered*

ROCK SHELTER SITE

Figure 2: *Over 100 implements were found under the blocks in the foreground*

implements made in the early Mousterian manner, under the large blocks in the foreground, suggested to Mr. Burchell's mind, as it would to most archeologists, that here at one time a rock shelter had existed which in the course of ages had collapsed. The wall of limestone seen in the photograph was supposed to have formed one side of this shelter, the other side of which has long since disappeared. Further, as the limestone in the area is covered in places by boulder clay, it is regarded as possible that the deposition of this material by ice, brought about the collapse of the roof of the shelter.

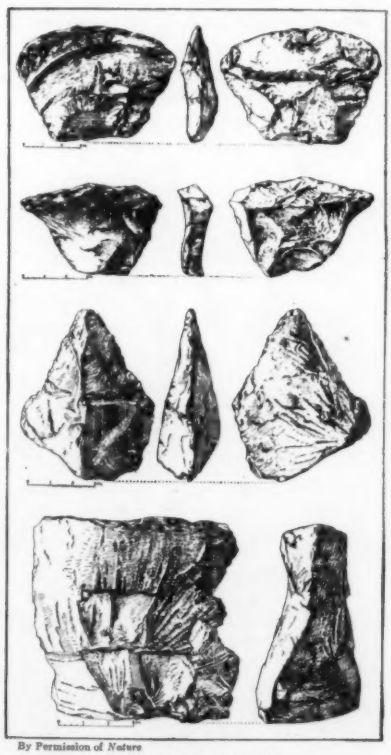
IT must, of course, be remembered that the site is reached by the sea at exceptionally high tides, and a certain number of the blocks now seen lying there have been moved to their present position by marine action. But the presence of undoubted implements of man in such a position, makes it necessary to postulate the existence there at one time of a shelter of some kind, comparable, possibly, with that shown in Figure 3, which is to be seen not far away from the Rosses Point site but farther to the south.

When a study is made of the instruments from Rosses Point it becomes abundantly clear that these are of early Mousterian forms, and made upon the general plan in vogue at that period.

The material used was the limestone so abundant in the area under discussion, and this rock which is so well jointed, as the photograph shows, was broken up into convenient "steaks," and by very skilfull flaking made into rough hand axes, *racloirs*, *pointes*, and scrapers. Two *racloirs* or side-scrapers are here illustrated (Figures 4 and 5). A large, pointed hand-axe is shown in Figure 6.

These specimens, especially the *racloirs*, are of definite Mousterian type such as have been found at the station of this epoch at High Lodge, Suffolk, England, and at the rock shelter of *le Moustier* in France. Also during recent excavations in a cave at Monaco, in the latter country, a series of implements has been found in the oldest layer which are made of limestone and bear a striking resemblance to many of the Sligo specimens. The Monaco artifacts are believed to be of the most ancient Mousterian culture, and thus support the interpretation placed upon those from Sligo.

Although the discovery at Rosses Point, while making it necessary to postulate great topographical changes since Mousterian times, seems to indicate that here was a place where the people of this epoch made their characteristic implements, yet these specimens were not found associated with a deposit of cave-earth and the bones of extinct animals such as are usually discovered in ancient paleolithic strata. Mr. Burchell accordingly made diligent search for further limestone implements in deposits of undoubted antiquity in the immediate neighborhood, and at Ballyconnel (Figure 1) was so fortunate as to find embedded in glacial boulder clay at a depth of 39 feet from the surface, two specimens which are of very real importance. In the first place, the age of these artifacts cannot be questioned and one of them (Figure 7) is a keypiece to the whole industry. It is a large "steak" of limestone and is a product in the first stage in the breaking up of the raw material. Unless its discovery had been made, the initial stage in the flaking process could only have been surmised. The other boulder clay specimen is a large flake made into



By Permission of *Nature*

THE ARTIFACTS

Top to bottom: *Figures 4, 5, 6 and 7, respectively, referred to in the article*

AN EXISTING ANALOGY

Figure 3: *This rock shelter suggests the former shape of the one shown in Figure 2*

a hollow scraper exhibiting the same technique as those found at Coney Island or at Rosses Point.

It is perhaps needless to say that Mr. Burchell's discovery and the interpretation he has placed upon it have already been hotly challenged by certain Irish archeologists and geologists, among whom are numbered Professor Macalister, Dr. Charlesworth and others. They deny upon geological grounds the possibility of the Rosses Point site ever having been a rock shelter, and claim that it cannot, owing to the inroads of the sea, be more than 100 years old.

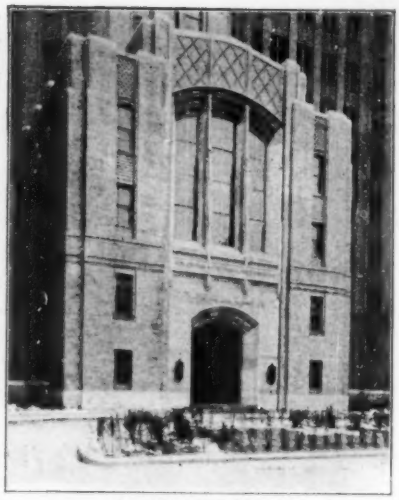
FURTHER, they state that the limestone specimens are not implements at all, but merely the result of rocks colliding with each other owing to the force of the waves, while the artifacts found in boulder clay are also regarded to be the product of some natural but unspecified agency.

Although I consider, in view of the types of implements found, that the geological conclusions of Mr. Burchell's opponents are unsound, they are nevertheless arguable and as such must and doubtless will be met. But the claim that the limestone specimens are the result of wave action, I consider preposterous and entirely unfounded. In reaching this conclusion I am relying upon an extensive observation of the effects of wave action in flaking stones and on a searching examination of all the specimens collected by Mr. Burchell, but readers of the SCIENTIFIC AMERICAN will be able by an examination of the implements here figured to come to their own conclusions as to which view is the more probably correct.

It is, of course, only right and proper that a discovery of such wide significance as that made by Mr. Burchell should be subjected to very drastic criticism before being accepted. This process is now going on, but it is my belief that he will be proved to be in the right and to have opened up a new chapter of ancient man's history in Ireland.

THE MEDICAL CENTER IN NEW YORK CITY

On the escarpment overlooking the Hudson is the great Medical Center, a consolidation of eleven hospitals, medical schools, and allied institutions. The group is harmonious architecturally

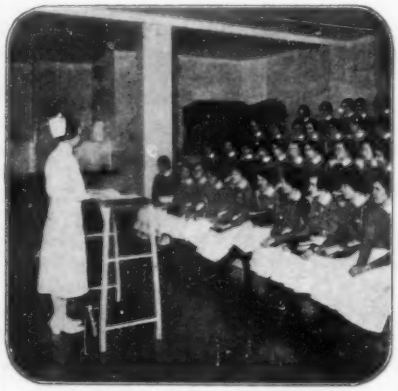


MAIN ENTRANCE

Over the entrance shown here are the words: "For of the Most High Cometh Healing"

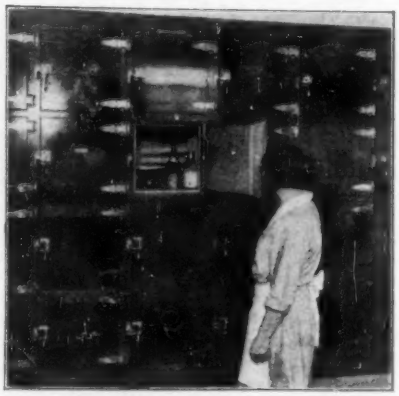
INFORMATION DESK

No, this is not a hotel office, but is the dignified entrance to the private pavilion



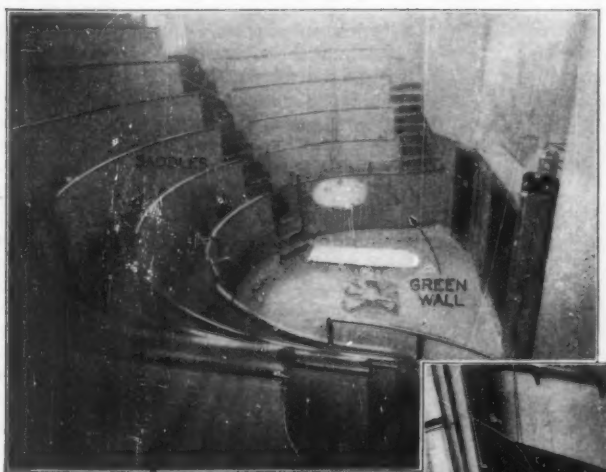
NURSES IN THE MAKING

A class in nursing is listening to a lecture. There is also a complete instruction ward



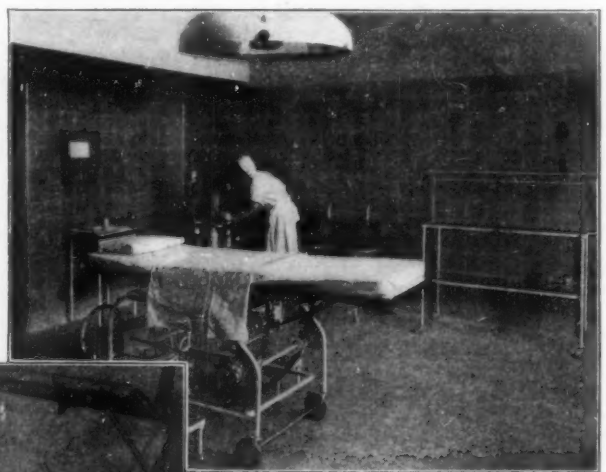
INDIVIDUAL REFRIGERATORS

The private patients have individual refrigerators to cool drinks and delicacies



THE OPERATING THEATER

The Andrew J. McCash operating theater extends through two stories and affords ample accommodation for 249 students. To economize space and give a better view of operation, saddles like those on bicycles are provided. The glaring white is toned to light green and the lower part of the amphitheatre is lined with green tile. Every convenience known to science is provided

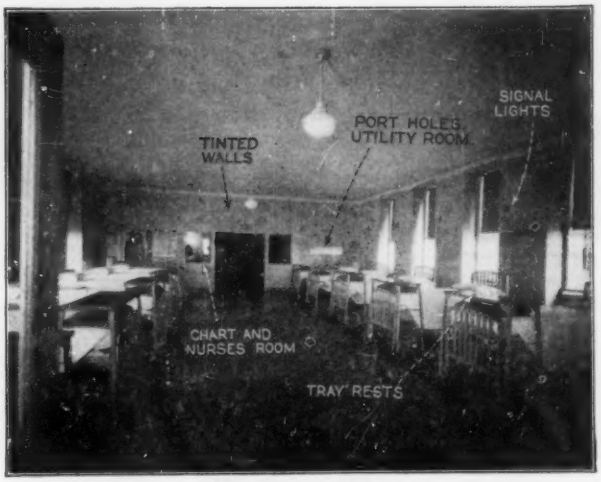


ONE OF THE OPERATING ROOMS

Like the operating theater, the operating rooms are lined with dark green tile, and every effort is made not to dishearten the patient. The operating rooms extend through two stories, and in the mezzanine there is accommodation for a few students who sit on saddles. A glass screen, see illustration at the left, prevents objects falling to the operating room proper below

NO KNOCKING RADIATORS

The hot water system of heating is in use so that there are no knocking radiators. The room, with decorations, does not suggest a hospital



ONE OF THE WARDS

Efficiency in hospital planning is exemplified in the wards. The interesting features are clearly shown and labeled in this illustration

Co-operation Extends Hospital's Scope

Massive Skyscraper Houses Consolidated Institutions

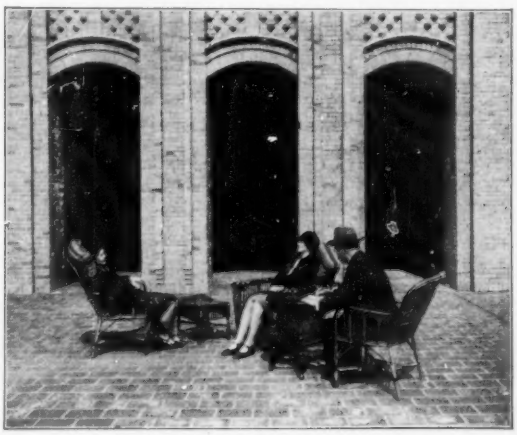
NEW YORK has witnessed in the last three years a significant development in co-operation—the establishment of a Medical Center wherein a general hospital, various specialty hospitals, schools of medicine, dentistry, nursing, and others, together with research laboratories, may all co-operate as a single unit with a three-fold aim of research, medical education, and care of the sick. The impressive group of buildings which rise above the Hudson River from West 164th to West 168th Street occupies the site of an old 20-acre ball ground where memorable games were played.

Some idea of the size of the main building may be gained when it is stated that its 22 stories house the Presbyterian Hospital, the College of Physicians and Surgeons, the School of Dental and Oral Surgery, Sloane Hospital for Women, Squire Urological Clinic, Harkness Pavilion, the Babies' Hospital, Vanderbilt Clinic, and a power plant. Some of these institutions are housed in wings which do not attain the full height.

THE NURSERY

Here the babies occupy little cots while glass screens serve to keep out drafts

WHILE an attempt has been made to take the "H" out of hospital, scientific cleanliness is never forgotten and every room in all the structures is immaculate. In the Harkness Pavilion for private patients the entrance lobby is exactly like that of a hotel. The private rooms are very cheerful and friends or relatives can secure accommodations on the same floor and can have meals à la carte or in a cafeteria. In Maxwell Hall we have the last word in quarters for the students, who in three years become full fledged nurses. Every young woman has a room to herself and the dining room has small tables for groups. There is a swimming pool and a delightful roof garden.



OUT ON THE TERRACE

There is one floor given over to convalescents where there is a music room, a gymnasium, lounges and terraces

In the Presbyterian Hospital there are 800 beds in wards holding 12 patients each, and single rooms which can be secured by those who cannot afford the prices charged private patients who must help pay to keep up this enormously expensive institution. The building is heated with hot water so there is no hammering of the pipes to add to the misery of sickness. If you are a private patient you can have your own personal refrigerator.

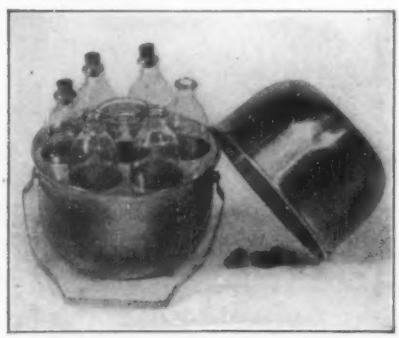
Of course an operating room is not a very cheerful place at best, but you can take off the glare by dark green tile and the knives and other unmentionable tools of the surgeon can be housed in inconspicuous cabinets set in the wall. The laboratories, and wash rooms for the surgeons and nurses are all equipped in the most modern manner. In the maternity hospital the nurseries with their little cribs always strike a responsive chord in the visitor's breast.

The latest estimate of the cost of the structures and equipment is over 20,000,000 dollars.

Inventions For the Home

HYDRAULIC DRAIN PUMP

Clogged drain pipes may be quickly and easily cleared by means of this force pump which utilizes the force of water from the faucet through a short length of hose.—*Albert G.Burns, 1924 Broadway, Oakland, California.*



COOKERY PARCHMENT

A new paper that has been developed for use in cooking to preserve all the natural flavors of foods. The prepared food is tied in a square of the paper, cooked, and then turned out ready for serving.—*The Paterson Parchment Paper Co., Passaic, N. J.*

BABY BOTTLE KIT

Designed by a famous baby specialist, this kit enables the mother to prepare six feedings at once. Ice may be packed around the bottles.—*Therma Products Co., Toledo, Ohio*

TELEPHONE-DESK

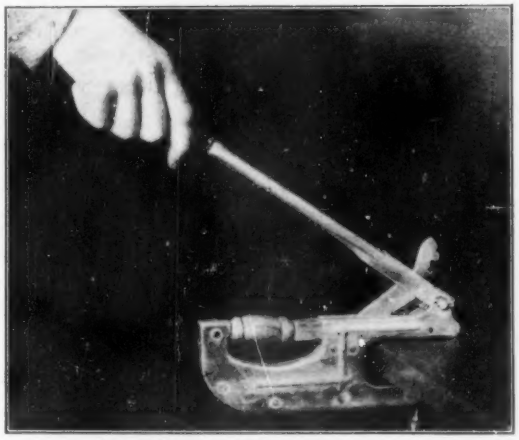
A combination telephone cabinet and desk that is attractive and should be very useful. The bell box is contained in the box at right of desk. *Wm. Cameron Co., Builder's Building Exhibit, Wacker Drive, Chicago*

SMOKELESS BROILER

Directly beneath the grill of this broiler there is an inverted cone through the central hole of which the melted fats pour into the reservoir beneath.—*American Banking Machine Corporation, Saginaw, Mich.*

ICELESS BEVERAGE SHAKER AND ICELESS MASSAGE CONE

At the left is a shaker and at the right is a complexion cone for giving a chilled facial massage, both of which depend for their low temperatures upon the interaction of chemicals and water. The freezing mixture consists of two powders which, when mixed within the devices with a small amount of water, lower the temperature below that of natural ice. In the shaker there is nothing to dilute the drink, since the mixture is inserted in the shell that surrounds the drink container. The massage cone is used to give the benefits of an ice massage without the usual drip. Shaker is aluminum or nickel-silver; cone is silver-plated.—*Cooling Devices of America, Ltd., 8 East 36th St., New York*

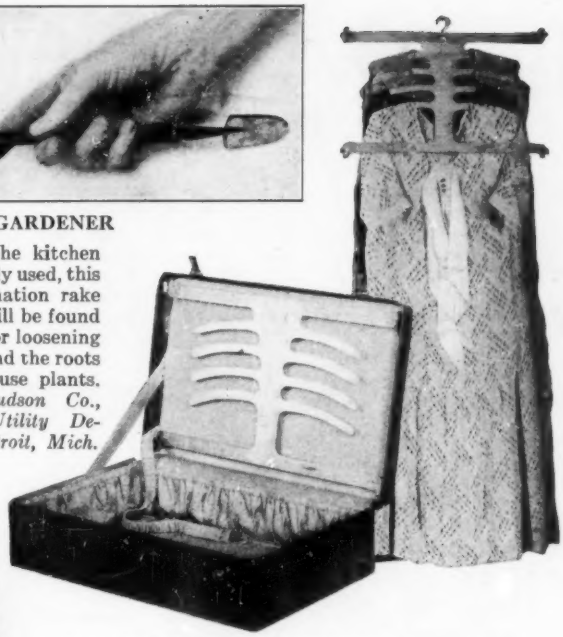


PECAN CRACKER

This new nut cracker has been designed to be attached to a table. Its strong leverage makes possible the cracking of a pound of pecans in a few minutes.— *G. L. Smith, 720 Beacon St., Los Angeles*

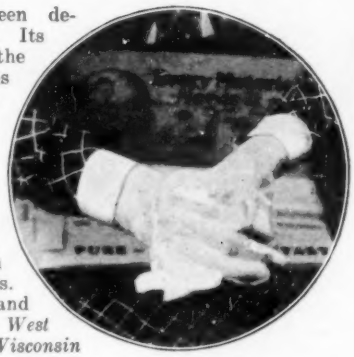
INDOOR GARDENER

To replace the kitchen fork commonly used, this small combination rake and shovel will be found convenient for loosening the dirt around the roots of potted house plants. —*J. L. Hudson Co., Household Utility Department, Detroit, Mich.*



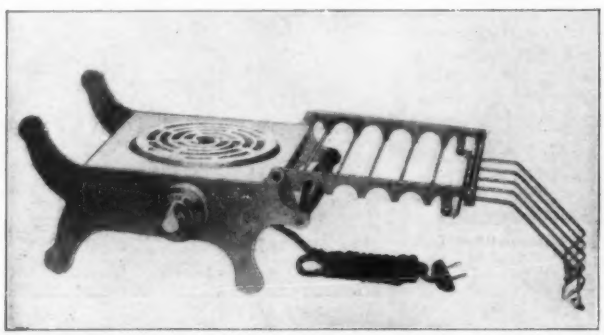
BAG HANGER TO PREVENT WRINKLES

This simple device, arranged to be clamped within a bag, offers a new solution to an old problem of travelers. Dresses, skirts, or suits, hung over the hangers, may be folded in the bag to minimize wrinkling. Removal and hanging of garments at the end of a journey is facilitated as shown here. —*W .W. Winship and Sons, Inc., Utica, New York*



PAPER SOAP AND TOWELS

Soap paper made of pure wood fiber and cocoanut oil soap, and towels of heavy absorbent paper, furnish a convenient combination for campers, tourists, and hikers. Each package contains soap and towels for 12 washings.—*Bay West Paper Company, Green Bay, Wisconsin*



FOLDING ELECTRIC GRILLS

The end "arms" of these two grills are arranged to act as legs when the grills are folded and stood up. The one at the left is a convenient bread toaster when stood upright. The grill shown at the right folds simply for convenience in putting it away on a shelf where the space may be limited. —*Foldex Electric Heater Company, 1435 Franklin St., Detroit, Michigan*

CORNER BRUSH

This useful new brush is made in the form of a cup that fits over the top end of an ordinary broom handle. It gets into corners and is always handy.—*A. Z. Bose, Willits, Calif.*

LEMON JUICE EXTRACTOR

Since this new juice extractor is made of nickeled wire, it will not break if dropped on the floor. It fits an ordinary drinking glass.—*F. W. Woolworth 5 and 10 Cent Stores* and *S. S. Kresge 5, 10 and 25 Cent Stores*

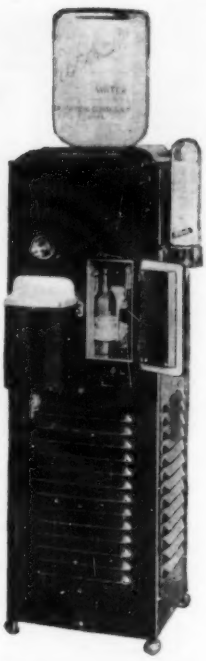
Inventions New and Interesting

LAWN RAKE

This new fan-shaped rake has prongs of tempered, flexible steel that are rigid enough for raking and springy enough for sweeping. Grass is not torn up from the lawn and leaves do not clog the steel prongs.—*Master Mfg. Co., 138 Davis Ave., Dayton, Ohio*

ICELESS WATER COOLER

One of a number of styles of cabinets, utilizing Frigidaire, which have been designed to cool bottled water in offices and factories. The compact cooling unit is in the lower part of the cabinet.—*The Charles E. Hires Co., 206 South 24th St., Philadelphia, Penna.*



SINGLE SHOT BLASTER

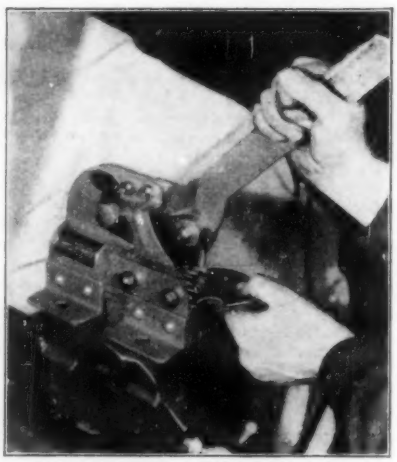
For use in mining or single shot blasting. Forcing the plug into the unit which looks like a flashlight, fires the shot. It contains three flashlight unit cells.—*National Carbon Co., Inc., New York and San Francisco*

WALL PAPER REMOVER

Steam, generated by an enclosed gas burner, penetrates and softens the paper. The outfit is portable and may be rapidly operated by one man.—*The Warner Mfg. Co., 529 S. Seventh St., Minneapolis, Minn.*

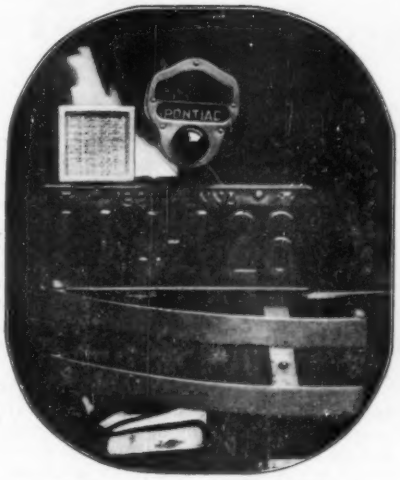
TEMPLATE CUTTER

The powerful leverage of this cutter enables the workman to "nibble" off bites from the most difficult curves. With it, a few swift strokes will cut a template that otherwise would require laborious, uncertain drilling and much filing.—*National Machine Tool Co., 1536 Clark St., Racine, Wis.*



AUTOMOBILE JACK AND STABLIZER

The automobile jack shown in the two illustrations above is also a stabilizer since it "damps" the rebound when the car hits an obstruction in the road. Coming in sets of four, these new jacks are permanently attached to the car. Each weighs eight and three quarters pounds and is attached to the spring between the axle and the end. In case of a puncture, the car may be raised quickly with a speed-wrench.—*Kant Fall Manufacturing Co., Sturgis, Michigan*



REFLECTOR TAIL LIGHT

The light from an approaching automobile warns its occupant when, on striking this device, it is reflected strongly. It uses no light of its own, but works on the simple principle of internal refraction.—*Catseye Reflecting Devices, Inc., Philadelphia, Pa.*

BREAKFAST SERVICE

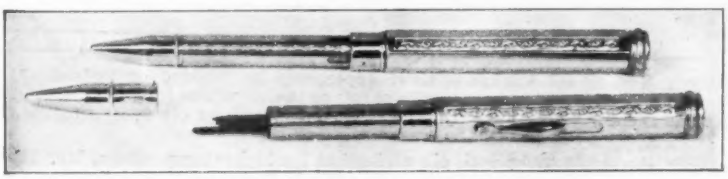
This three-tier tray facilitates the serving of light meals in the room of a club or hotel guest. The shelves, held together by a handle, hold food and all the dishes necessary. Its white cover also serves as a small table cloth.—*Servidor Company, 101 Park Ave., New York*

ASH RECEIVER

With this unique device, the regular ash can used by homes and large buildings, is placed on the elevator and lowered by a hand crank into the pit under the heater. The ashes are deposited by gravity in the can, ready for removal.—*The Ash Uplifter Co., Miller Building, Scranton, Penna.*

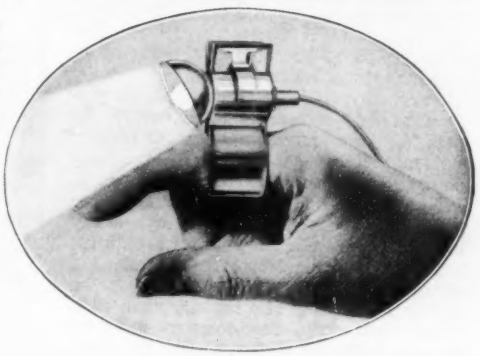
WIND INDICATORS

The direction and velocity of wind foretells the weather. Above is shown the indicator which is installed far below the roof on which the instruments at the right are installed. The vane swings with the wind and a light flashes behind the proper letter on the indicator dial. In the center of the dial is a light which flashes the number of times a minute to correspond to the miles-per-hour wind speed shown by the anemometer.—*Charles E. Lord, 24 Milk St., Boston, Mass*



FOUR-COLOR MAGAZINE PENCIL

Pencil leads of four different colors, any one of which is ready for instant use, make this pencil valuable for checking work. The two ends telescope together. In order to write, the two parts are drawn apart slightly and turned until the proper color shows. When pushed together again, that color lead projects.—*Educational Exhibition Company, Providence, R. I.*



FINGER LAMP

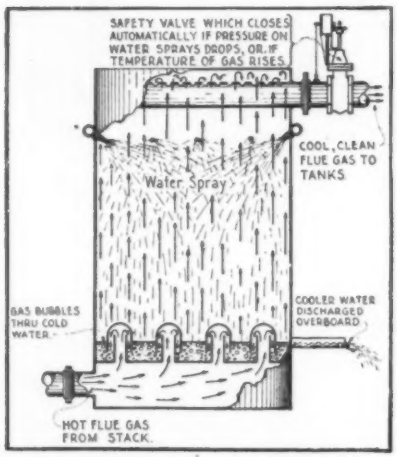
Many uses will be found for this convenient lamp which gives light where it is most needed but leaves both hands free.—*Digit Mfg. Company, 272 Lafayette St., New York*

The Scientific American Digest

A Review of the Newest Developments in Science, Industry and Engineering

Lightning Stroke Electrocutes Tree

A FREAK stroke of lightning apparently electrocuted a large white oak tree in the New York Botanical Garden during the summer. The tree was struck during a thunderstorm, but was not shattered as trees frequently are by lightning. Almost immediately, however, the leaves began to wither, and within a month the tree presented an autumnal appearance against the bright green of the rest of the grove. Continued observation convinced the garden authorities that the tree was dead, and that it had apparently died instantaneously. After it was cut down, a ring count gave its age at approximately 200 years.—*Science Service.*


SAFETY VALVE WHICH CLOSES AUTOMATICALLY IF PRESSURE ON WATER SPRAYS DROPS, OR IF TEMPERATURE OF GAS RISES
COOL, CLEAN FLUE GAS TO TANKS
Water Spray
GAS BUBBLES THRU COLD WATER
COOLER WATER DISCHARGED OVERBOARD
HOT FLUE GAS FROM STACK

Spray chamber aboard an oil tanker for cleaning and cooling flue gas that is to be pumped into tanks

Safeguarding an Oil Tanker

MILLIONS of barrels of highly inflammable petroleum products are each year transported by the tankship fleet of the Standard Oil Company of California with the splendid record sustained of never a serious explosion or fire.

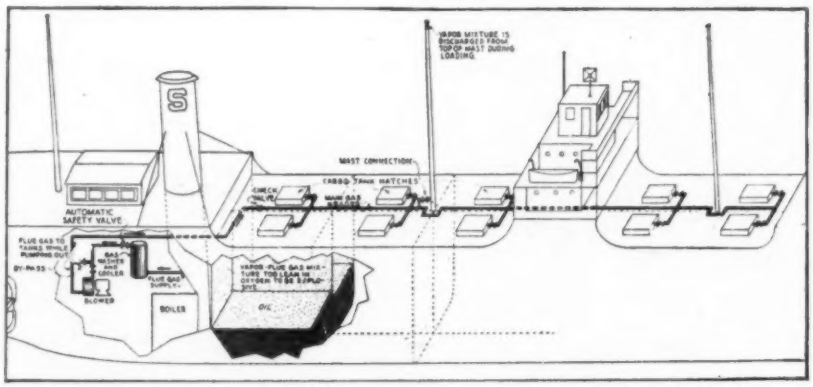
In contrast to this really remarkable performance, other tankers have, during the past few years, suffered a number of very serious accidents, causing large property damage and regrettable loss of life.

Now the Standard Oil Company proposes to increase still further the safety precautions by the adoption of a plan for practically eliminating the presence of oxygen in all cargo compartments. In the ordinary operation of a tanker, when oil is pumped out of the cargo compartments, air flows in through the vent to take its place. The mixture of remaining petroleum vapors and the oxygen in the air is likely to produce an explosive mass in the tanks. Now, it is well known that combustion of any kind cannot take place without the presence of oxygen. Hence, this explosion hazard could be entirely eliminated by filling the tanks with some gas which contained little or no oxygen.

Fortunately, no special apparatus for the manufacture of such a gas is necessary on a steamship, for tremendous quantities of flue gas, from which the oxygen has been consumed by the boiler fires, are constantly passing up the stack.

At first thought, this plan of using gases from the boiler-stack might appear to be anything but a safeguard for the ship; but if the drawing is examined closely, it will be noted that the first thing that happens to this mixture of gases when it is withdrawn from the stack is to pass through a cooler. The detailed illustration shows how thoroughly this device insures against any hot gas or incandescent particles of soot getting anywhere near the oil-tank. As the gases enter the washer from the stack, they first pass out under a series of "bubble-caps" and rise through a pool of water in the bottom of the washer. Then as they continue up through the main chamber of the washer, they pass through a deluge discharged from the sprays which encircle this chamber at the top. In this way the gases, which come from the stack at a temperature of perhaps 400 degrees or 500 degrees, Fahrenheit, are cooled down to practically the temperature of the sea-water constantly circulated through the washer.

If for any reason the gases coming from the washer should become too warm, they melt a fusible link and allow the automatic valve to close. As a still further safety feature, the automatic valve is also set so that it will close if the pressure on the water-line supplying the nozzles of the cooler drops below a certain point.



In safeguarding an oil tanker against explosions in loading or unloading, flue gas is drawn by a blower into the spray chamber where it is washed and cooled. It is then distributed by pipe lines to the various oil compartments

While filling the ship's tanks with oil, a further safety feature of this flue-gas system comes into play. When an ordinary tanker is loaded, the vapors that have to be expelled from the tanks to make room for the oil are simply pushed out of the vents, or "ullage-holes" onto the deck of the vessel. The presence of this inflammable vapor calls for extreme precautions throughout the loading period. When loading starts, instead of opening the ullage-holes, as has previously been the practice, the valves to the flue-gas lines are opened and the tank vapors are pushed out through the flue-gas lines into a hollow mast which discharges them high in the air.

When it is necessary for men to enter the tanks for cleaning or repairs, explosive gases are eliminated by operating a special blower to pull flue-gas out of the stack, through the washer and force it through the distributing pipe-lines. Then the usual "wind-sails" can be used to displace the flue gas with fresh air.

Cabbage Plant Produces Six Heads

A CABBAGE plant that produced six cabbage heads in turn, one above the other, and has finally ended its career with a crop of viable seed at the top of the eight-foot "stalk," is an unusual occurrence that is likely to go down in botanical history.

This plant was produced by keeping it at a high temperature of 70 degrees, Fahrenheit, and above, steadily for over two years, according to Julian C. Miller, of Cornell University, who conducted the experiment. Seeds were produced only when the plant was removed last November to a cooler greenhouse where the temperature averaged from 55 degrees to 60 degrees, Fahrenheit.

This cabbage is one product of a series of experiments that show that controlled temperature has an important effect on crops such as cabbage or beets that normally require two years to complete the cycle of fruit and seed. Vegetative growth continues so long as the plant is kept at the higher temperature, Mr. Miller has found. Seeds are not produced until the temperature is lowered, bringing about the necessary changes within the plant.

Ordinarily, farmers and seed growers put cabbage plants in storage through the winter and set them out the second spring to produce seed. Recent experiments at Cornell show that the cabbage plant re-

quires only a two-month rest period in storage at 35 degrees to 40 degrees, Fahrenheit, after which the plants can be transplanted to a greenhouse for seed production. In this manner the two-year cycle can be compressed into one year. This method is particularly desirable for growing the first and second generation seed of any cross or selection.

Experiments on annual plants by W. W. Garner and H. A. Allard, of the United States Department of Agriculture, proved the importance of length of day in the maturing of annual crops. In the case of the cabbage, Mr. Miller has found that increasing the amount of light had no effect, but temperature appears to be a controlling factor of great importance.—*Science Service.*

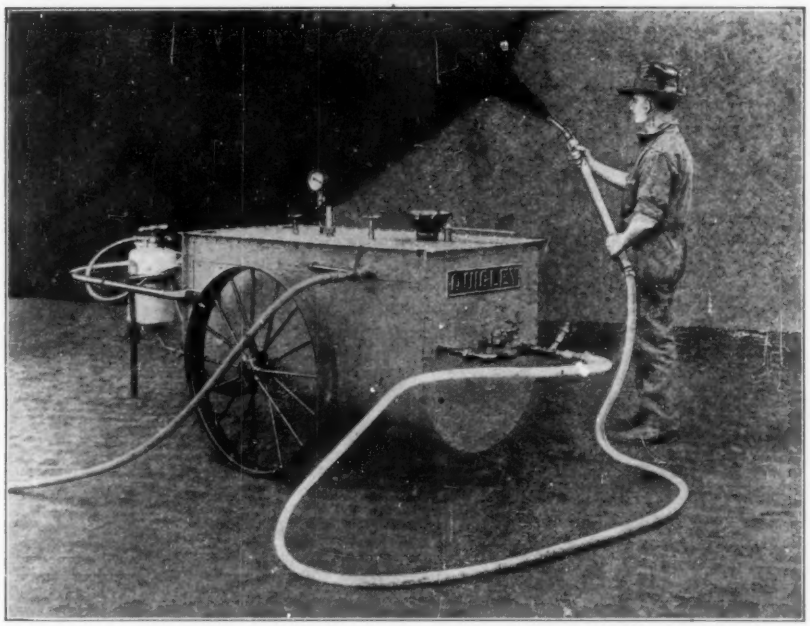
Bitumen Spray Gun

SPECIALLY designed for applying hot tar, asphalt, and other waterproofing or protective materials to concrete, water tanks and reservoirs, pipe lines, penstocks, et cetera, a new bitumen gun has been developed by the Quigley Furnace Specialties Company of New York City. It is an adaptation of, and similar to, the refractory gun which has been made by this company for years.

Compressed air is used in this gun to operate a piston which forces the liquid out. The air does not, however, come in contact with the material. The formation of the spray is mechanical and due only to the piston pressure. To operate the gun, 15 cubic feet of air a minute is said to be required.

For hot spraying, preheated material is put into the cylinder above the piston through a charge opening in the top of the machine. The temperature of the material in the gun is maintained at the proper point by a small self-contained kerosene burner, a large-scale thermometer being conveniently placed in view of the operator.

A special insulated metallic hose is used, and it is claimed that the machine will discharge the material any distance up to several hundred feet with a drop in temperature of not over three degrees for each 25-foot length. The discharge end of the nozzle can be turned at an angle in order to reach restricted spaces, and special nozzles are available for certain requirements that may come up in practice.



The compact, easily portable bitumen spray gun by means of which preheated liquids may be sprayed on concrete, water tanks and reservoirs, et cetera

The gun is completely inclosed in a steel housing mounted on wheels and is readily moved from place to place. It has a capacity of 15 gallons, or sufficient to cover about 400 square feet of surface with one filling.—*Power.*

Frozen Meat Seems Fresh

BRITISH brains have been hard at work to make palatable the famous roast beef of England, that has to come in these degenerate days all the way from Australia or South America.

The freezing process necessary to carry the meat on its long journey dries up all the natural juices. It has been found, however, at the Low Temperature Research Station at Cambridge that when beef is frozen and then thawed very slowly, practically no fluid is lost. In one experiment, the time consumed in freezing and thawing took nearly 80 days, at the end of which the meat was hardly distinguishable from fresh. If this method can be applied in industry, it will be of considerable commercial importance, it is believed.—*Science Service.*

A New Type of Concrete Reservoir

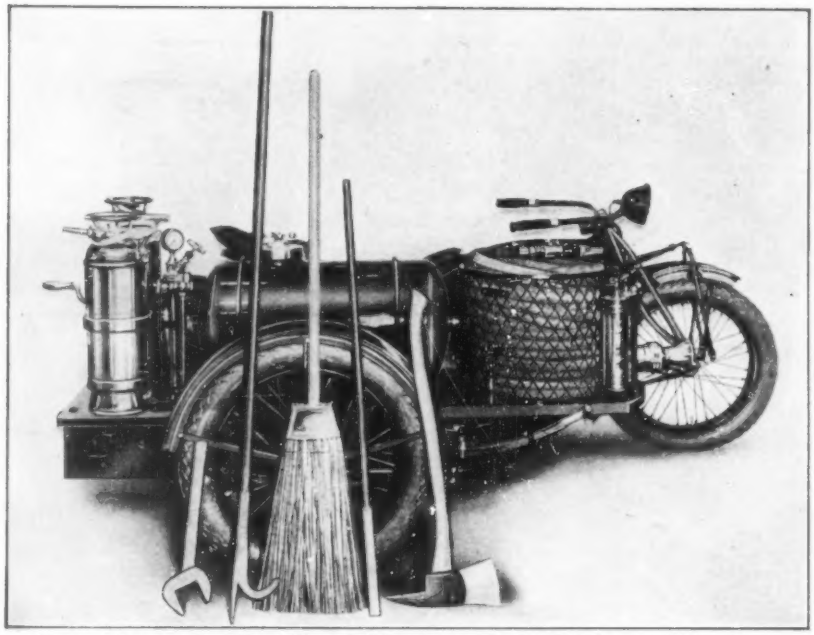
IN the plain of San-Eulalia, Province of Téruel, Spain, a unique water reservoir has recently been built of concrete, reports *Le Genie Civil.* This region is characterized by an extremely dry climate, and in order to achieve better agricultural results, one of the local land-owners installed an irrigation system utilizing the flow of a well by means of a compound motor-pump delivering 2000 liters a minute. To facilitate the regular distribution of the irrigation water at convenient times, it was necessary to construct a reservoir holding 700 cubic meters.

Since the funds available for this purpose were limited and the earth formation at this point was very poor—being inconsistent clay—the unique reservoir that was finally decided upon and built was thought to be the most feasible.

Photographs courtesy *Le Genie Civil.*

Exterior view of the unique water reservoir that was recently built in Spain. This indicates clearly the manner in which the slightly arched sectors were supported by vertical ribs which rest on a concrete, 15-point star base

Interior view of the reservoir partly filled with water. The arch design and the gentle slope of the sides are readily apparent. The arches extend to a circular plaque at the base. It's capacity is 7580 cubic feet of water



Due to the speed and mobility of this motorcycle fire-fighting auxiliary, it can easily precede heavier equipment in answering a fire alarm or fight small fires

The reservoir basin was built in the form of a wide open cone, the walls of which consist of 15 identical sectors, each lightly arched. The joint between each pair of adjacent sectors is supported by a rib resting on a base which forms a star with 15 points. The center of this base consists of a circular plaque which constitutes the bottom of the reservoir. By building the reservoir in this form, the difficulties offered by the ground formation were overcome and a surface of sufficient support was obtained.

The construction work on this project was accomplished in 50 days and the total estimated cost was 7500 pesetas. The designer was Juan Cordobes, highway and bridge engineer of Téruel.

New Uses For Cadmium

IN spite of the relatively high price of cadmium, the metal is beginning to find a number of important applications, says the *Industrial Bulletin* of Arthur D. Little, Inc. It has recently been applied to the rust-proofing of locks, hardware, automobile parts, and wire products by a process which involves electroplating the cadmium thereon, and subsequently heating the plated articles for several hours, whereby the cadmium coating is alloyed with the metal of the plated article. A small proportion of cadmium is often alloyed with silver to make the latter more resistant to tarnish.

An especially promising application of cadmium appears to be in its addition to copper intended for wire-drawing. These alloys have a higher tensile strength and annealing temperature and greater resistance to abrasion than hard-drawn copper, and as only a small proportion of cadmium confers these benefits, its addition does not seriously reduce the electric conductivity of the wire.

Cadmium is also finding limited use in jewelry, as it gives green alloys with gold, and it is employed to some extent in fusible alloys. Its addition to aluminum is advantageous where the aluminum is to be used in the manufacture of aluminum powder. The addition of cadmium in this instance improves the color and luster of the powder and makes it more resistant to atmospheric corrosion when used in paints or lacquers.

One of the latest uses reported for metallic cadmium is in the manufacture of tungsten electric light filaments. An alloy of 42 percent cadmium, 53 percent mercury, and 5 percent bismuth, is impregnated with tungsten powder. The mixture is made into wire by the extrusion process, and after passing through a die, is heated to drive off the alloy, and finished by heating in a vacuum to consolidate the tungsten.

According to *Engineering and Mining Journal*, production of metallic cadmium in the United States in 1927 amounted to 1,074,645 pounds, an increase of 33 percent over 1926, as reported by producers to the United States Bureau of Mines. During 1926 and 1927 its price remained at 60 cents a pound but recent increase in the demand for cadmium as a plating metal has caused the price to rise to 65 cents.

Fire-fighting Auxiliary

WHAT is perhaps the world's smallest efficient piece of motor-driven fire apparatus has been designed and is now being manufactured by the Indian Motorcycle Company of Springfield, Massachusetts. It consists of a motorcycle to which is attached a side-car chassis holding a complete set of fire-fighting equipment.

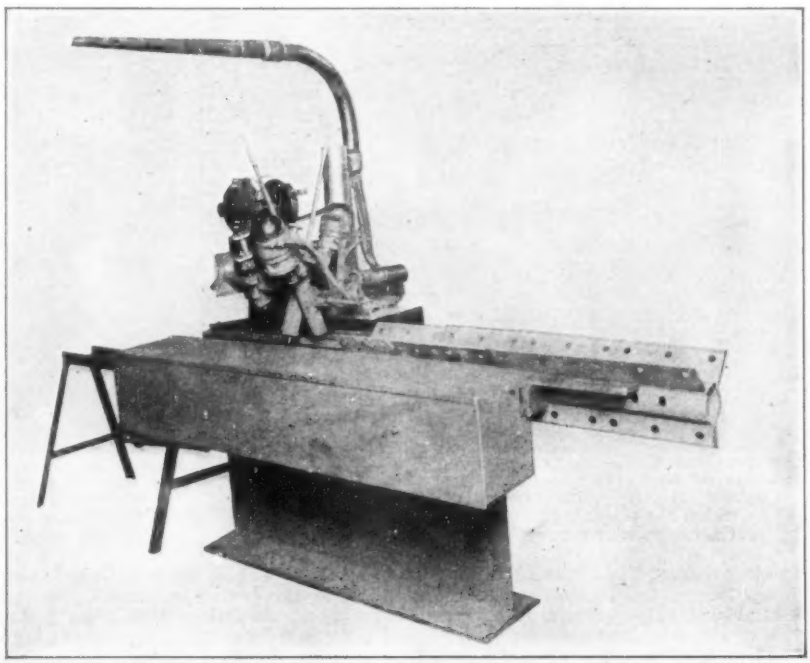
The equipment consists of a 25-gallon chemical tank, a two and one half gallon foam extinguisher, a two and one half gallon soda-and-acid extinguisher, (all of the fire department type), and four small extinguishers. Other pieces of equipment carried are: hydrant wrench, plaster hook, fire broom, crow-bar, fireman's axe, and 100 feet of chemical hose in a wire basket.

The entire equipment is only about eight feet long and four feet wide. Its speed is said to be about 65 miles an hour. Thus it should prove a valuable adjunct to airports where, in the event of a crash, quick action may be necessary in fighting the resulting fire. In cities throughout the country it is already being used as an auxiliary. Its speed and maneuverability enables it to reach a fire long before the heavier apparatus can arrive.

Details of New Welding Process

WHILE the Electronic Tornado welding process was mentioned in the SCIENTIFIC AMERICAN Digest in the April issue, this was in effect an advance notice,

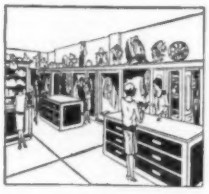
(*Please turn to page* 462)



The complete Electronic Tornado welding machine for welding oil derrick clamps. Note welding heads and electrode holders crossing each other at an angle. The process is said to be adaptable to many kinds of welding jobs

This *grainless* wood board can be cut out, punched, die cut and shaped!

Has a smooth, attractive surface on the face side and requires no paint for protection. Also takes any finish beautifully. Possesses uniform strength, highly resistive to moisture, very dense and tough. New uses discovered almost every week. Send for large free sample, and find out what you can do with Masonite Presdwood.



FOR STORE FIXTURES

If you are a manufacturer, an inventor or a mechanic of any kind, you will certainly want to know all about Masonite Presdwood, the *grainless* wood board of a thousand uses.

Presdwood has now been on the market over two years, and in scores of industries it has helped to make good products better and cut down operating costs.

In fact, results prove that Presdwood is workable and adaptable almost beyond belief. It can be cut out. It can be die cut and punched. It will not crack or check. It will not split or splinter. It can be used on saw, planer, sander and shaper. It is highly resistive to moisture, it has uniform strength, it is very dense and tough. It has a smooth, attractive surface on the face side, requires no paint for protection, and takes any finish beautifully.

"A truly wonderful product," says practically everybody who has put it to the test. And note particularly that Presdwood contains no foreign substance of any kind, not even a chemical binder. It is simply wood torn apart and put together again — clean, fresh wood straight from the forest, and nothing else!

Astonishing range of uses

There actually seems to be no limit to the uses for Presdwood. We ourselves are astonished almost every week by some entirely new and unexpected demand for it.

Not only are thousands of feet of it going into the making of such things as table tops, breakfast nooks, store fixtures and signs, but it is being extensively used in the manufacture of toys, doll houses, fire screens, tension boards, bread boxes, clothes hampers, and dairy containers.

FOR PANELING

Bank vaults and telephone booths are lined with Presdwood. It is being widely used in building steam boats. It makes an ideal flooring for dance halls and park pavilions. It is becoming more and more popular for all kinds of paneling.

Cooling trays for hot castings, starch trays for candy factories, bedroom screens, invalid trays, incubators, dust arresters for journal boxes, bowling alleys, and shutters for Dutch Colonial Houses—all of these things are made of Presdwood.

Where especially fine, smooth work is required, there is nothing like Presdwood for concrete forms. Presdwood is used extensively in making movies. Not forgetting that the Chicago Art Institute has found this *grainless* all-wood board an excellent material for backing and protecting rare works of art!

Try Presdwood yourself

Presdwood has scores of other uses, and new uses are being discovered week after week. Remember, too, that Presdwood is not only workable almost beyond belief, but that it positively will not damage tools.

Adaptable for any woodworking machinery, uniformly strong, and highly resistive to moisture, it can also be lacquered, painted, stained or varnished. And yet it requires no paint for protection.

Write for a large, free sample of Masonite Presdwood, and find out what it will do for you. It may be the very material for which you have long been looking. It may enable you to make a worthwhile improvement in your product, and at the same time lower your operating costs. Try Presdwood for yourself!

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FOR PLAYHOUSES AND TOYS

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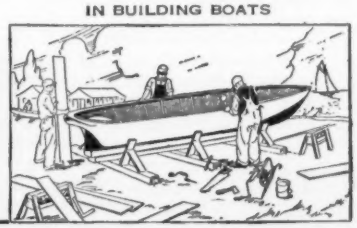
Made by the makers of
MASONITE STRUCTURAL INSULATION

IN BUILDING BOATS



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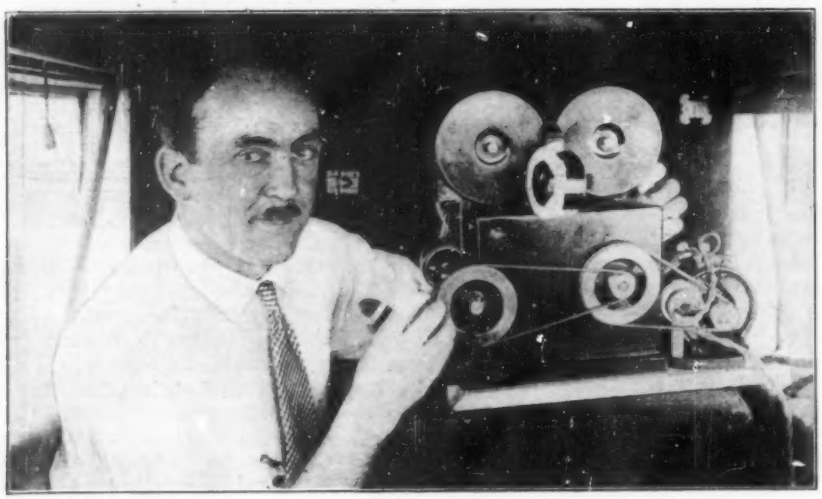
Learning to Use Our Wings

This Department Will Keep Our Readers Informed of the Latest Facts About Airplanes and Airships

CONDUCTED BY ALEXANDER KLEMIN
In charge, Daniel Guggenheim School of Aeronautics, New York City

Developing Motion Pictures in the Air

THE development of motion pictures in the air so as to save time in their delivery to Broadway theaters is another airplane achievement. Competition in the delivery of motion pictures of the Republican National Convention at Kansas City was naturally very keen. The Ritchfield-Paramount News-Associated Press flying laboratory undertook the task of developing films in the air.



Henry Cuthbertson with part of the aerial "movie" finishing apparatus

It was intended originally to use the Fokker-10, a large machine with ample space in its fourteen-passenger cabin. The Fokker was unavailable at the last moment and a five-passenger Ryan brougham, similar in design to the famous *Spirit of St. Louis*, had to be used instead.

The cabin behind the pilot's cockpit was converted into a dark room. The first problem was to procure developing tanks, drying racks and a printing machine that could be installed in the very small space available. A battery was installed to drive the printing-machine motor.

Negative titles were made in advance as it would have been impossible to set up type in the airplane, in addition to the other operations necessary. Since the program of the convention was known, these titles could be easily written ahead of the event itself.

The negative was developed on a spiral reel, then immersed in a hypo tank and finally washed enough to keep the film about two weeks. Racks which could be revolved inside the cabin were used to dry the negative, which ran about 100 feet in length. The windows were opened and the propeller wash of the plane practically blew the water off the film. The negative was then cut and the titles inserted. It was then ready for printing.

The major part of the work was done while flying over the Alleghany Mountains between Cleveland and Bellfonte. Fog brought the plane down for several hours in its 1200 mile journey, and for part of the route the weather was too bumpy for developing work. Nevertheless the films were delivered on Broadway many hours ahead of all others which had been delivered by plane, but developed later on the ground.

Parachutes for the Entire Plane

NO ARMY, Navy or air-mail pilot ever goes aloft without wearing a parachute. Jumping with the parachute has now become an accepted part of an airman's training, and after the first few jumps it becomes almost a matter of routine. Pilots sometimes purposely delay the pulling of the rip cord so as to get more of a thrill out of their jumps. In all commercial flying, where passengers are not carried, the parachute is of indisputable value.

Where passengers are carried on transportation lines, the matter is more complicated. If the pilot carries a parachute and the passengers do not, there is always the danger that the pilot may jump and leave the passengers to their fate—although our devoted airmen are not likely to desert their charges in such fashion. Therefore pilots are not allowed to carry parachutes in passenger transportation.

The question arises whether both pilot and passengers should be provided with 'chutes, which would be the counterparts of life belts at sea. Unfortunately very few passengers can be relied upon to jump at the crucial moment. In an enclosed cabin monoplane, the passengers would probably find it impossible to jump.

European practice is strongly against the use of parachutes for passengers, but both in Europe and in the United States a number of devices have been seriously considered to increase passenger safety via a jump through space. One suggestion is that the passenger cabin be connected to a parachute, which could be released by the pilot and sustain the cabin in safety while the rest of the plane hurtles through space. Another suggestion is that all passengers wear parachutes which will open automatically, and that at the will of the pilot all passengers would be launched through the floor into space. This idea does not seem particularly pleasing.

Perhaps the most attractive idea is that of a giant parachute which could sustain the entire plane in case of need.

This is the plan on which Major E. L. Hoffman of Wright Field is working. He has developed and is perfecting a giant parachute 84 feet in diameter. It is structurally a reproduction of the usual man-carrying type, having a pilot 'chute, vents in the dome and the same weight and quality of silk and the same type of shroud lines. It has more panels than the ordinary 'chute, namely 96, and more shrouds, namely 48.

Many tests have been performed with this giant 'chute. A 1600 pound bomb has been twice released from a bombing plane flying at an altitude of several thousand feet. One difficulty that developed in these tests is that the lift of the parachute was so great that it refused to deflate on striking the ground and carried the weight of 1600 pounds a great distance across the field before it could be halted. A positive

The Ryan cabin plane that carried the portable picture developing equipment

Red — STANDARD—Suits most writers. A splendid correspondence point. Medium flexibility. For home and general use.

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The popular way today is to pick your pen point by color. Thousands by this simple method are now enjoying real writing comfort for the first time. Quickly and accurately, from six different styles, you select the pen point best suited to your way of writing. The perfectly balanced No. 7 stainless holder of Ripple Rubber, fitted with a personally selected point, assures permanent fountain pen satisfaction. Without further delay ask the nearest merchant to show you all six styles of No. 7.

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The same accurate method for securing perfect pen point performance is now available in Waterman's new movable Gyro-Sheath Desk Sets. By far the most practical desk ornaments ever offered. Of onyx and marble in modernized classical outlines, they are creations of rare beauty. And the Special No. 7 pens, with color band inlay on artistic tapering holders of Ripple-Blugreen, Ripple-Olive and Ripple-Rose, complete a variety of ensembles of exceptional charm. Ideal for office or home use, or, as gifts of distinction.

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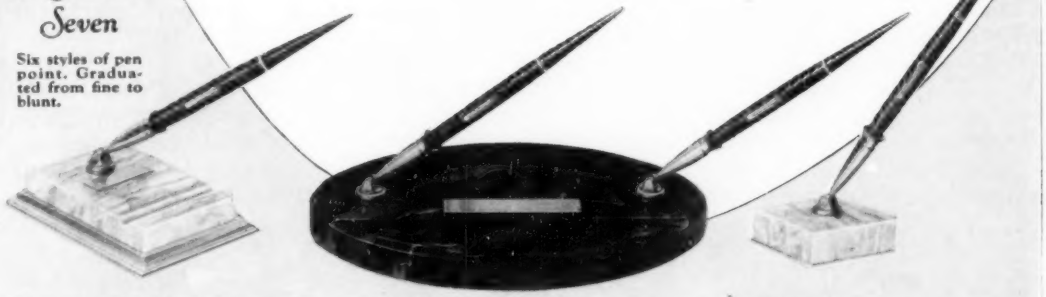
Number Seven

Six styles of pen point. Graduated from fine to blunt.



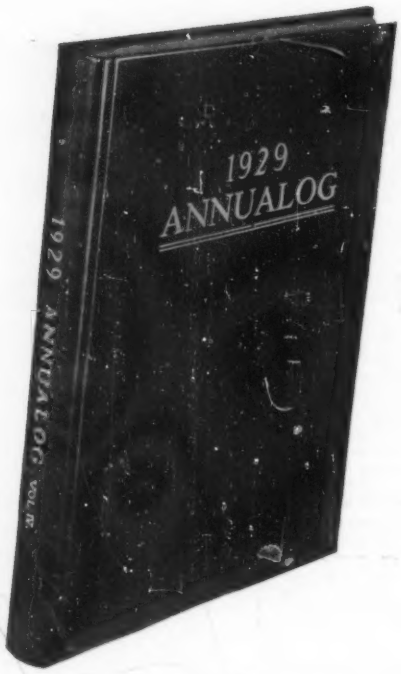
Desk Set No. 7167—Onyx base, green gold finished frame and name plate, 3 x 4½; price $18.00

Desk Set No. 6467—Black and gold marble oval base, 7 x 10; two pens; price $30.00

Desk Set No. 6067—Onyx base, 2¾ x 2¾; price $10.00

Desk pens may be had in all color holders and all styles of nibs

Waterman's



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The Scientific American Annualog for 1929, the unique reference book, different in matter and manner from any other publication in the world (except the Annualogs that have preceded it) is now off the press.

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Model SF-46, 2-ton capacity, with 6-cylinder engine and 4 forward speeds.

Models SD-44 and *SD-46* (4 and 6-cylinder). Heavy-Duty Speed trucks, especially designed for dump and trailer work. Four-speed transmission and cantilever rear springs.

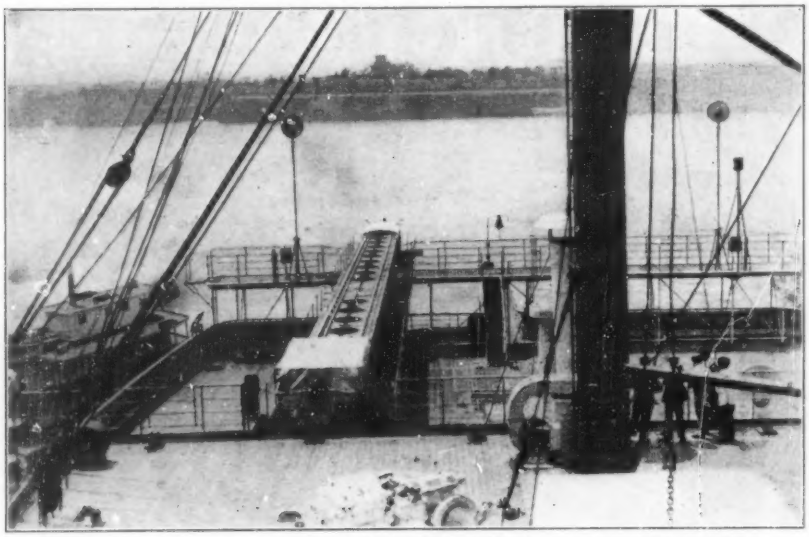
In addition to the Speed Trucks, the International Line also includes Heavy-Duty trucks ranging from 2½-ton to 5-ton sizes, Motor Coaches, and McCormick-Deering Industrial Tractors. All are sold and serviced by 169 Company-owned branches throughout the United States and Canada, and dealers everywhere.

INTERNATIONAL HARVESTER COMPANY
OF AMERICA
606 So. Michigan Ave. (INCORPORATED) Chicago, Ill.

INTERNATIONAL

release mechanism is being designed which will separate the parachute from the weight carried when the ground is struck. A quick deflation method also is possible.

In California, a plane parachute has actually been used to lower a "Jenny" plane, although with somewhat indifferent results. Major Hoffman is quite confident that he can perfect a reliable and simple parachute that will sustain the largest plane at need.



Catapult runway on the after deck of the *Ile de France*, This is designed for use with an amphibian plane, which is a necessity for the work to be done

Catapulting Off a Liner

A GREAT many of our warships now carry fighting or observation planes on board, and catapult them from gun turrets which can be swung into the wind no matter what its direction. It has often been suggested that similar methods could be employed on board ocean liners to expedite the delivery of mail, and our readers will no doubt remember that Clarence D. Chamberlin, the transatlantic flier, has actually flown a plane off the *Leviathan*, making his get-away from an inclined platform and flying safely to land. Chamberlin used a Sperry Messenger, lightly loaded, and needed only a comparatively low speed and a short run to get safely into the air.

With a heavy mailplane, a simple runway, even though inclined, may not suffice. Accordingly, on the French liner *Ile de France*, a catapult has been installed. While the details available are scant, it is fairly clear that the catapult consists of a carriage moving on two rails, and pulled by a cable which is wound up by a compressed air motor. The runway will be 100 feet in length. Compressed air is no doubt being used because it can be made to furnish a great deal of power for a very short time, and can be made to exercise its full power at very short notice.

The catapult is placed on the after-deck and is in charge of Lieutenant Commander Demourgeot, who arrived here to study landing facilities on shore and the various formalities that might have to be met. He has already launched his plane off the *Ile de France* as she neared port at both ends of her run.

An amphibian is necessary because the craft must be capable of alighting at say Curtiss Field, or the Newark Airport, and at the same time, in case of engine failure, must be able to take care of itself at sea. Depending on the mail load carried, weather conditions and other factors, it is hoped to save from 20 to 36 hours on the delivery of transatlantic mail. The plan will only be available to passengers after it has been thoroughly tested out with mail.

Picking Up Mail in Flight

SINCE the function of the airplane is above all to save time, it is a fascinating idea that a plane should be able to pick up or discharge a mail or freight load without landing. *Air Transportation* reports some interesting experiments in this direction, made by the inventor, Dr. Lytle S. Adam at Seattle, Washington, quite recently.

A Travel-Air OX-5 biplane was employed to snatch up a 35-pound pouch of air-mail matter. The equipment in the plane consisted of a drum on which was wound a steel trailing cable fitted at the end with a small steel ball. A safety spring in the drum allowed immediate unwinding of the cable if entangled with an object on the ground. On the ground the load to be picked up was held ready in a large metal trough, V-shaped, and with sides eight feet high to guide the steel ball.

The unit was mounted on a turn-table so that it might face directly into the wind. The ball was dragged through a sand approach into this large slot until it reached a narrow slit and engaged an aluminum thimble. The thimble in turn was connected directly by a short piece of cable to the load. For large loads where inertia might create a serious problem, the load is to be hurled forward at a speed of 45 miles an hour by a spring trap that is released automatically when the ball engages the thimble.

Giant Seaplanes

ADVOCATES of the airship maintain that for transatlantic flying, the airship is far superior to the airplane because of its greater range and carrying capacity. Seaplane constructors in Germany challenge this assertion. They are of the opinion that very large seaplanes can be built, equipped with so many engines that the danger of power plant failure will disappear, and with hulls so large and sturdy that they can outride the roughest seas.

The Rohrbach Company is building a series of eight three-engined flying boats of the Romar type, which are to be put in service between Germany and the Argentine. The Romar has three engines of 600 horsepower each and is one of the largest planes ever built.

(*Please turn to page 467*)

P and A

A demonstration of the device for picking up mail bags from a speeding plane. At left is the reel carried on the plane, and at right, a model of the trough

and

. . . *via* Western Electric

THE very program tnat goes on the air through the well-known Western Electric microphone and broadcasting equipment can come into your home through the Western Electric No. 560-A.W. loudspeaker!

Wake up your radio with this new voice.

Let it tell you of the wonderful things there are in the air — things you do not suspect and cannot enjoy until you have a loudspeaker that brings them to you, in every delicate tone from the highest, sheerest violin tremolo to the deepest, fullest 'cello note.

All-around quality is inherent in this Western Electric loudspeaker. It is part of a 50-year old tradition covering a whole family of related products in the field of communication, including the nation's millions of telephones and network of switchboards and cables.

Western Electric

LOUDSPEAKER

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ELECTRIC COMPANY

Through authorized dealers everywhere

Industries From Atoms

A Department Devoted to the Advancements Made in Industrial and Experimental Chemistry

Tiny Tablet Sterilizes Drinking Water

"SOME little bug is going to find you some day" ran the pessimistic refrain of a song popular when "germs" first gripped the public's imagination. The little bug's chances of connecting get slimmer with each advance of chemical science, and now with the announcement of succinchlorimide, the drinking water route to our vitals is barred to him. Developed by the United States Army Medical Corps, succinchlorimide is prepared in tablets, one of which, simply dropped in bacteria-infested water, promptly and permanently terminates the malicious career of the disease carriers.

Succinchlorimide is expected to prove a great boon to soldiers in the field, campers, tourists, and others who often find themselves in the open country without any effective means of sterilizing water, said Major C. B. Wood of the United States Army Medical School, who discussed the new disinfectant before the Institute of Chemistry recently. Major Wood expects the substance to be officially adopted by the Army and Navy Departments.

"By working with a derivative of succinic acid containing active chlorine, we hit upon this new succinchlorimide," says Major Wood. "A tablet or two of this will kill all disease-producing germs in a canteen of water. The taste is barely changed. The compound does not—as far as we know—deteriorate, this giving it a decided advantage over bleaching powder, which was formerly used for the purpose."

Dust Induces Rain

ALTHOUGH the chemist was one of the first to brand the claims of professional rain-makers as nonsense and quackery, he is interested in the possibility of inducing precipitation by truly scientific methods. While it is impossible to produce rain from an atmosphere that does not contain sufficient moisture, scientists have found that various forms of dust, added to air saturated with moisture, bring about precipitation.

An interesting demonstration of this phenomenon was given before the Institute of Chemistry recently by Professor C. F. Knipp, of the University of Illinois. Taking a vessel in which the air had been saturated with moisture just short of precipitation, he introduced dust by lighting a match near the retort and allowing the smoke to filter in. Immediately the fog turned into rain.

There is a mathematical reason for this assistance from smoke, or any other dust, in making rain. The drop of water gets itself wound around a particle of dust as a nucleus and therefore falls with greater force. Raindrops are sometimes as large as one-twentieth of an inch in diameter.

In some parts of the country, firing of cannon has been employed in making the rain come down. This has been believed to be through aiding atmospheric condensation, but what really happens is that the firing of the cannon does not bring the rain down so much through concussion and condensation as through the dust raised, which acts as nuclei for the condensation.

Not Angry —Just Too Sweet

THE angrier one gets, the sweeter he becomes, declared Dr. Oliver Kamm, director of the Chemical Research Department of Parke-Davis and Company's laboratories at Detroit at a recent session of the Institute of Chemistry.

"Anger increases the secretion of the suparenal gland, the blood pressure is raised and the sugar content of the blood is increased," said Dr. Kamm. Sugar is a fuel for the blood, it was explained, and it is needed in increased quantity during any excitement.

Heretofore, science has been able to make but a limited study of the glands, believing that each had but one hormone, or speeder-up of body processes. But now, according to Dr. Kamm, who is an authority on glandular chemistry, two hormones have been discovered in one gland at least.

"Later on, when we refine our work," he said, "we may discover more, and eventually, it is hoped, science will be able to manufacture them synthetically.

"It has already been discovered," continued Dr. Kamm, "that the pituitary gland possesses two hormones. These are both so closely alike that they have been called chemical twins. But the functions are different, one being used in raising blood pressure and the other in aiding child-birth.

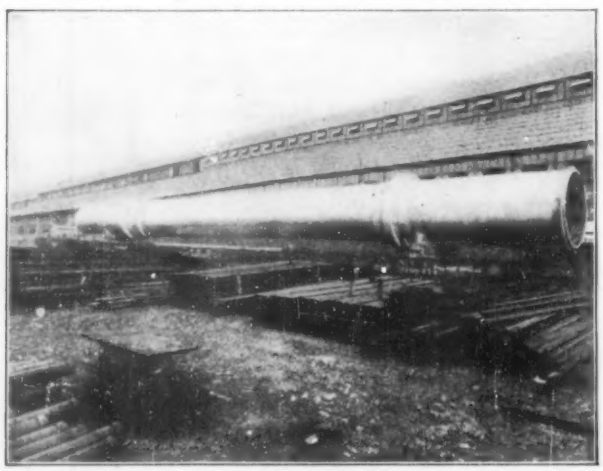
"Possibly the thyroid will be the next gland to yield a second hormone."

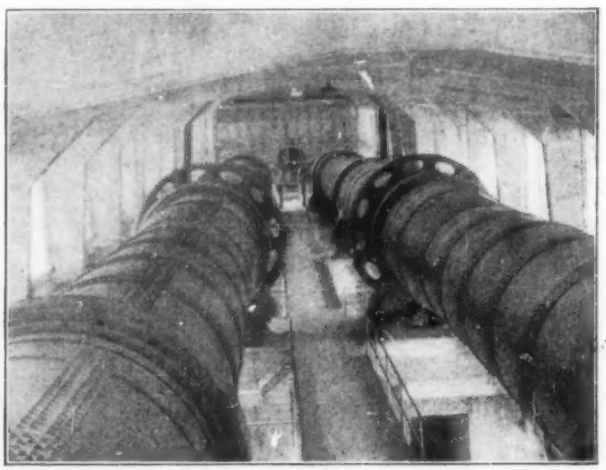
Vitamins Glorify the Oyster

VITAMINS keep cropping up in the most unexpected places and give us new respect for some of the foods we have been eating all our lives without giving them proper credit for supplying us with these mysterious substances so vital to our health.

One of the latest investigations conducted by the Bureau of Chemistry of the United States Department of Agriculture glorifies the oyster as a good source of vitamins A, B, and D. Fresh Chesapeake oysters were frozen, ground, and fed to albino rats. Two grams of oyster furnished sufficient vitamin A to cure rats of xerophthalmia.

Tests made by the curative method showed that 3.5 grams contained nearly

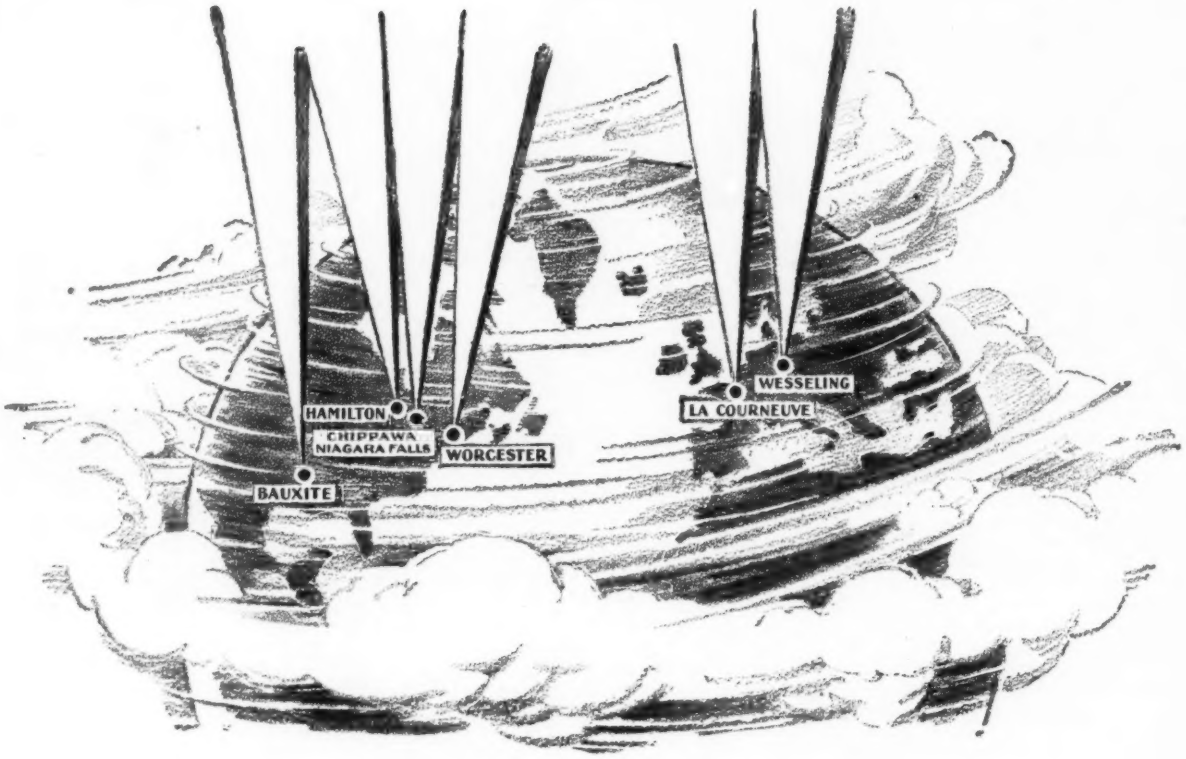




This rotary lime kiln (left) would be remarkable for its size alone, as it is 125 feet long, eight feet in diameter, and is built of five-eighth inch plate. From a technical point of view, however, it is interesting as an example of the application of welding to the construction of large equipment. This particular kiln was tested against two others of riveted construction (right) and found to be the stronger. Also, the omission of butt straps reduced the weight 14 percent, and thus saved considerable in first cost and in lower power consumption and upkeep

For All the World—

Norton Abrasives



The part that abrasives and grinding play in our life today is most unusually portrayed in a motion picture film, "The Age of Speed." Suitable for meetings of civic clubs, engineering societies, industrial organizations. Loaned upon request.

NORTON abrasives, trade-marked Alundum and Crystolon, are made to meet the requirements of metal workers the world over.

Norton manufacturing facilities include bauxite mines in Arkansas, electric furnaces at Niagara Falls, N. Y. and Chippawa, Canada, grinding wheel making plants in Worcester, Mass., Hamilton, Ontario, La Courneuve, France and Wesseling, Germany.

Norton grinding machines, floors, refractories and porous plates are produced in the home plant in Worcester.

NORTON COMPANY
WORCESTER, MASS.

NORTON

Grinding Wheels
Grinding Machines

Refractories-Floor
and Stair Tiles

enough vitamin B to supply the needs of young rats. For long continued normal growth, however, a little more than five grams was required. Five grams of oyster given to rachitic rats daily for 10 days induced slight calcification of the bones comparable with that produced in the same length of time by four milligrams of good cod-liver oil. Thus those who like oysters may find added satisfaction in the thought that they are taking their vitamins while indulging their palates.

In England, British research experts have found a way to produce what they call a synthetic vitamin D by the use of ultra-violet light. Because of the comparative shortage of natural sunshine, it is proposed to use this process to increase the health-giving properties of butter and other foods to make up for the lack of sunlight. It is claimed that foods thus treated cure tendencies toward such diseases as rickets which result from improper diet and insufficient exposure to ultra-violet light.

The non-rigid C-7, the first airship to be inflated with helium

Romance of Helium Gas

BEFORE anyone had ever seen or heard of the element helium, chemists were convinced that such a substance existed somewhere. This belief was based on a gap in the periodic table—that classification of all the known elements in order of their atomic weights which disclosed the family relationship of certain groups and made possible the prediction of the properties of undiscovered elements which would fit in the blank spaces.

And as they say in the bed-time stories—where in the world did they find helium? The strange part of it is that this strange gas was first discovered, not on the earth at all, but on the sun by means of the spectroscope. Later, when radium was studied by chemists, it was found that helium gas was one of the products formed by the "decay" of this remarkable substance. Still later, helium was found to exist in small amounts in some natural gas.

Romantic as is the history of helium, modern applications of its useful properties are equally appealing. Foremost, of course, is its use in lighter-than-air craft, a development which must be largely credited to the United States Navy. Although not possessing quite the lifting power of hydrogen, helium is non-inflammable and consequently is much preferred for safety considerations.

From its function in the clouds, helium now descends to an equally romantic role in the waters under the earth, since it has been found to be ideally adapted, in mixture with oxygen, for the mitigation of "caisson sickness" or "the bends" in deep sea diving and underwater work.

The illustrations show the first dirigible inflated with helium and some views of one of the very few plants producing the gas commercially.

"Radio Chemistry" Gives Promise of Synthetic Oil

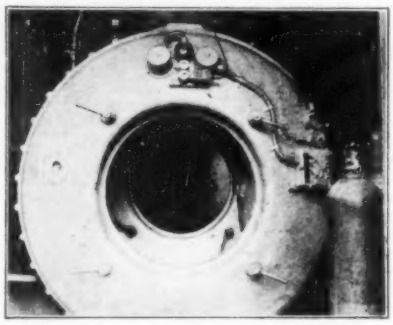
"RADIO Chemistry," a new field in chemistry, which is one of the results of the discovery of radium, seems to make possible the breaking up of a heavy petroleum into gasoline. By a similar method, light natural gases may be used to form the heaviest oil.

This wizardry of chemistry, recently described by Dr. Samuel C. Lind, director of the University of Minnesota School of Chemistry and former director of the Bureau of Mines, may be of no practical importance at the present time in this country, but it is likely to be important in countries which have natural gas and little petroleum, or in countries which have neither. Fuel experts look with interest on the experiments and believe that they may bring some startling changes.

Since natural gas contains the same elements as lubricating oil, namely hydrogen and carbon, it is only necessary to re-arrange the atoms into more complicated molecules to convert gas to oil. Dr. Lind's experiments indicate that electronic bombardment of the molecules may bring about the re-arrangement at the will of the scientist, once he learns to apply and control his new tool.

Millions in Precious Metals Used in American Mouths

THE amount or value of the precious metals consumed in dentistry is probably amazing to most people. The American people use almost as much gold, silver and platinum to modernize their masticating facilities as they do to adorn themselves with jewelry. In view of the magnitude of this consumption of the precious metals, it is not strange that metallurgists have recently turned their attention to the specific and very exacting requirements of the dentists.

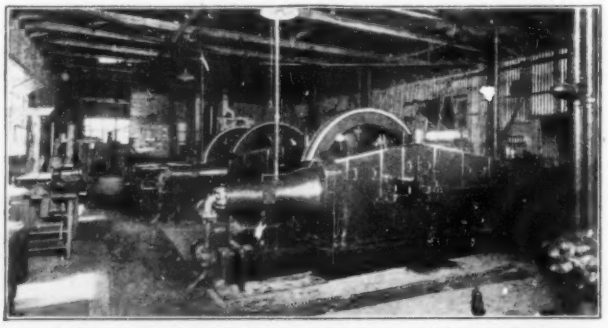


Synthetic mixtures of oxygen and helium are employed in this double compartment caisson for mitigation of "bends" or caisson disease. Double doors allow entry to main compartment by first building up pressure in outer compartment

Reginald B. Williams, addressing the American Institute of Mining and Metallurgical Engineers recently, explained that the demands made upon manufacturers by the dentists are extremely varied. They must supply metals of tensile strength ranging from approximately 30,000 to 100,000 pounds per square inch and even more. The metals must be workable and

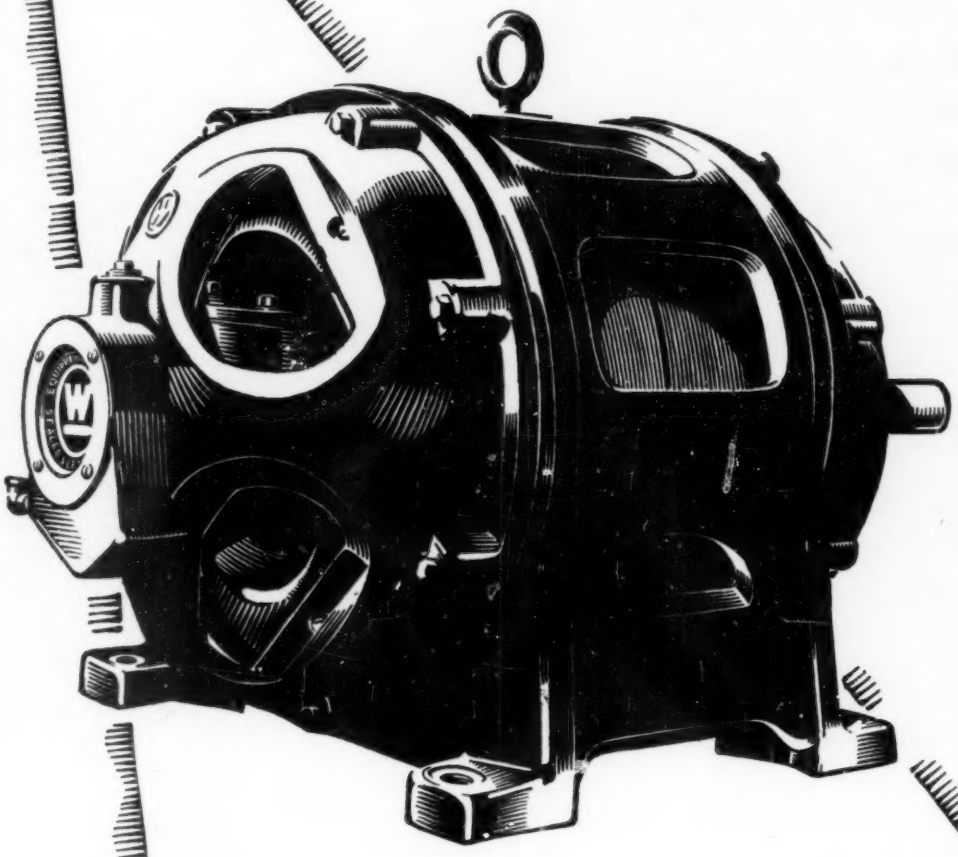
(*Please turn to page* 470)

The helium extraction plant of the Helium Company, from which helium is shipped to Lakehurst, New Jersey



A battery of Cooper gas compressors used in the Helium Company's plant. Helium is recovered from natural gas

MORE THAN THE MOTOR RESTS ON THE BEARING



In the chain of modern mass production no single part is independent of the others. Motor performance is more important than ever before; motor bearings are more important. ' ' ' Westinghouse motors have *Sealed-Sleeve bearings.* Oil can't get out; dirt can't get in. The chief cause of motor burnouts—oil soaked windings—is eliminated.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
East Pittsburgh Works, East Pittsburgh, Pa.
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Westinghouse Motors
With Sealed-Sleeve Bearings

X-53178

Strays From the Ether

A Monthly Review of the Progress Made In All Branches of Radio Communication

Tracing the Radio Echo

VAGRANT radio waves which circle the North Pole and return to receivers in the earth's temperate latitudes have been given by Dr. J. Barton Hoag of the Ryerson Physical Laboratory, University of Chicago, as the probable cause of radio "echoes" which scientists have as yet been unable to explain.

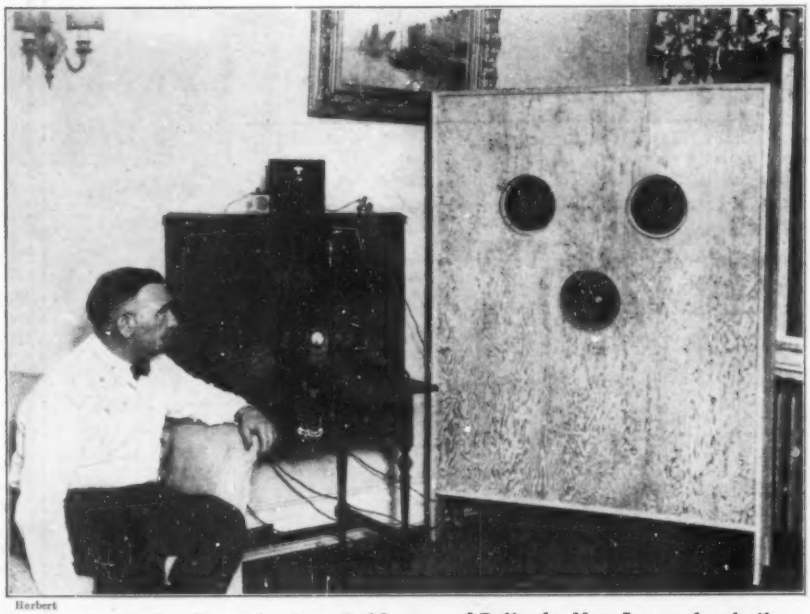
Signals which have traveled entirely around the world and returned to be recorded near the point of transmission, or radio energy which is apparently directly reflected back to the earth from the "radio-roof," account only in part for the echo signals noticed by Dr. Hoag and other experimenters, according to a University of Chicago report.

It was pointed out that the returning energy of the echo was received before the elapsed time required for the signal to circle the globe, but too late to be considered as returning energy reflected from the "radio-roof," or Kennelly-Heaviside layer.

Dr. Hoag suggests that at the North Pole the "radio-roof," or reflecting layer, forms a deep inverted bowl above the earth, rising to perhaps 300 miles above the normal height of the layer. He said the radio waves might revolve in this bowl before descending to actuate his electrical recording apparatus.

According to Dr. Hoag, the "echo" signals are received on a high-speed photographic film, which is exposed at the rate of five feet per second, at intervals of .01 to .04 of a second after the main wave. The time interval indicates that the signal is traveling much farther than vertically to the "radio-roof" and return, and not nearly as far as the round-the-world path. It requires about one seventh of a second for radio energy to circle the earth, since radio energy travels at approximately the same speed as light, or about 186,000 miles a second.

Dr. Hoag and his associates believe the results attained from the experiments will be fruitful in solving long distance radio transmission troubles. It has been found necessary to work at night because the "echo" signals fade out as the sun rises.



Herbert

Here is a real radio enthusiast. O. Mampe, of Palisade, New Jersey, has built this baffle-board loudspeaker. The board measures four and one half feet wide by five and one half feet high. Three dynamic speaker units are used

The First Paid Radio Message

THIRTY years ago radio telegraphy was officially adopted as a public means of communication when Lord Kelvin paid Senatore Marconi one shilling for the transmission of the first paid message.

This historic message was sent by Lord Kelvin, who at that time, with Lady Kelvin and Lord Tennyson, was visiting Senatore Marconi's experimental wireless station at Needles, Isle of Wight. In order to show his appreciation of the work the inventor of radio had accomplished and to illustrate his belief in its commercial future, Lord Kelvin insisted upon paying one shilling each for wireless telegrams which he sent to Sir George Stokes, at Cambridge; to Lord Rayleigh and Mr. W. H. Preece, in London; and to Dr. McLean, his chief assistant in the physical laboratory of the University of Glasgow.

The message from Lord Kelvin to Sir George Stokes was as follows:

"This is sent, commercially paid, at Alum Bay, for transmission through ether. One shilling to Bournemouth and thence by postal telegraph, 15 pence, to Cambridge."

During the 30 years which have elapsed since this incident at the Isle of Wight, wireless telegraphy has achieved more than Lord Kelvin could have foreseen, and today there is hardly a corner of the world which cannot be reached by wireless communication in which wireless does not take its part in daily communication routine.

Where Radio Reception Is a Crime

HOW often have you said or heard, "It is a crime to broadcast such stuff as that?" And the speaker may literally be right. But would you call it a crime to listen in?

In European countries where receiving sets are subject to a Government tax, a spy system is unavoidable if the license fee is to be uniformly and equitably distributed. This involves the imposition of penalties upon the so-called radio pirates.

In Soviet Russia, for instance, to own and operate a receiving set without Government license is an infraction bordering upon criminality, if we are to measure the offense by the penalty imposed. The way of the transgressor is exceedingly hard if he is proven guilty of "clandestine listening." The maximum penalty is three years imprisonment.

A boy in Leningrad, recently haled to court on a charge of operating a radio receiver without license, was found guilty and sentenced to hard labor for a period of three months. The judge, in determining

Herbert

A rear view of the baffle-board speaker shown above. The three units and the power amplifier are plainly visible. The baffle itself is made of seven-eighths inch wood

Step into the laboratory, and see why

LISTERINE

full strength is effective against

SORE THROAT

Have you tried the new
LISTERINE SHAVING
CREAM?
Cools your skin while you shave and keeps it cool afterwards. An outstanding shaving cream in every respect.

Prevent a cold this way? Certainly!

Millions of ordinary colds start when germs carried by the hands to the mouth on food attack the mucous membrane. Being very delicate it allows germs foothold where they develop quickly unless steps are taken to render them harmless.

You can accomplish this by rinsing your hands with Listerine, as many physicians do, before each meal. Listerine, as shown above, is powerful against germs.

Use only a little Listerine for this purpose—and let it dry on the hands. This simple act may spare you a nasty siege with a mean cold.

It is particularly important that mothers preparing food for children remember this precaution.

WHY is Listerine full strength so successful against colds, sore throat and other infections?

The test outlined below answers the question scientifically and convincingly. It discloses the power of Listerine—unchanged in 47 years.

Step into the laboratory a moment. In one test tube are 200,000,000 of the M. Aureus (pus) germ. In another, 200,000,000 of the B. Typhosus (typhoid) germ. These are used by the United States Government for testing antiseptics.

Now Listerine full strength is applied to them. A stop-watch notes results. Within 15 seconds every organism in both tubes is dead, and beyond power to harm the body.

With this evidence of Listerine's germicidal power, appreciate why you should gargle with Listerine at the first sign of sore throat—for sore throat, like a cold, is caused by germs.

Listerine full strength may be used with complete safety in any body cavity. Time and time again it has checked irritating conditions before they became serious. You can feel your throat improve almost immediately. If not, consult a physician. The matter is then no longer one for an antiseptic.

For your own protection use Listerine systematically through the winter months. It may spare you a long siege of illness. Lambert Pharmacal Company, St. Louis, Mo., U. S. A.

Acme

Chief radio operator Malcolm P. Hanson of the Byrd Antarctic Expedition, with some of the airplane radio equipment that the expedition will carry

the penalty, gave as his reason for "leniency" the youthfulness of the offender. And yet, despite the severity of the punishment meted out to this class of lawbreakers, it is estimated that 15 percent of the broadcast listeners in Leningrad are radio pirates, in the light of the Government definition.

Balm For Weary Radio Souls

WRITING under the *nom de plume* of Ariel, a columnist in *Popular Wireless* (England) advances some valuable suggestions to a correspondent. We reprint Ariel's paragraph herewith:

"A reader who professes himself to be bored with the everlasting reception of jazz, et cetera, from distant stations, asks me to suggest 'fresh woods and pastures new.' Very well! I suggest that he study the theory and practice of radio and then explore and try the methods of measuring signal strengths; and the direction and characteristics of X's [static. *Ed.*]. Frame-aerial [loop. *Ed.*] work is fascinating, but needs a little scientific knowledge. And then there is a world of space for experiment in the observation of short-wave transmission. Let him learn Morse and then plunge into the vortex of stations all over the globe."

Power to Spare

"POWERFUL enough to fill a large auditorium with music!"

The person who is about to purchase a loud speaker may wonder why this statement, applied to dynamic speakers, should interest him when he only desires a speaker with volume enough to fill a living room.

Such statements should mean as much to the prospective purchaser of a reproducer as "80 miles an hour" means to the purchaser of a motor car.

Motorists have learned that even though they may never want to travel above a moderate speed, cars rated to go much higher ride much smoother at the lower speeds than do those, the maximum speed of which is low. Vibration at moderate speed is reduced to a minimum in high powered cars.

And so it is with loud speakers.

Although a listener may never care to operate his speaker at a volume in excess of that necessary to make the tones audible a few feet from the receiver, smooth, true tones are made possible by the great reserve power of a dynamic speaker. Reserve power is just as useful in a reproducer as it is in an automobile. When an auto comes to a high hill the reserve power permits it to go up without loss of speed. When a radio receiver pulls in a weak signal, the dynamic speaker's reserve power permits it to be heard without loss of volume.

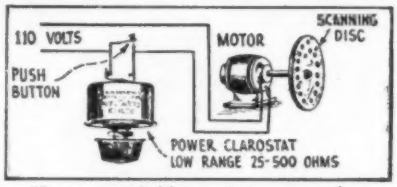
British Colony Broadcasting Station

KENYA, South Africa, has the distinction of being the first British colony to possess a short-wave broadcasting station.

Controlling the Television Scanning Disk

ONE of the tricks in achieving successful television reception is the synchronization of the receiving scanning disk with that at the transmitting end. This phase calls for an exceedingly accurate control of the speed of the motor which drives the receiving scanning disk, for otherwise the image is distorted very much after the fashion of the reflection of one's self in the trick mirrors at amusement parks—or, worse still, there may be no image at all to look at. While automatic control is possible, it is costly and complicated at this time, and it is only adding confusion to the delicate work of getting strong images, according to S. H. Anderson of the Clarostat Manufacturing Company.

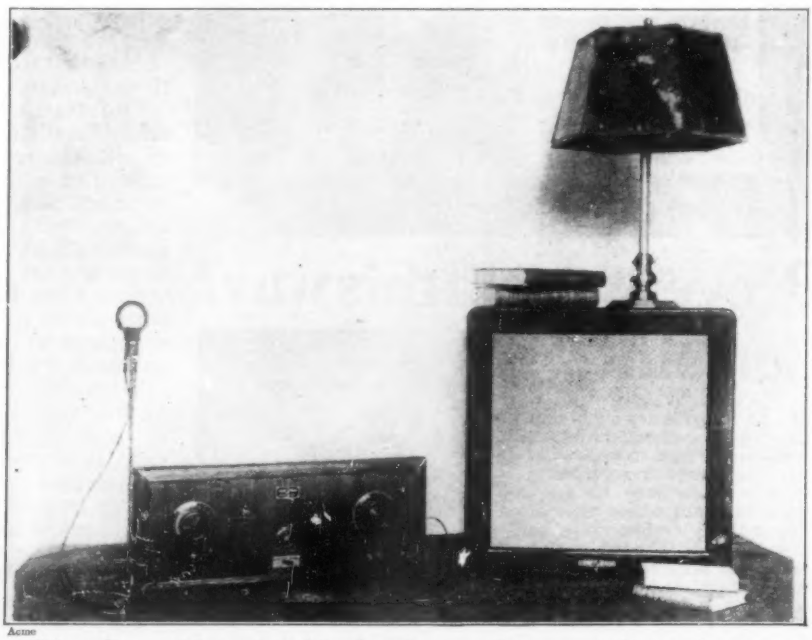
"At present the most satisfactory method of obtaining synchronization in television reception," stated Mr. Anderson, "is manually. A power clarostat is introduced in the motor circuit, as shown in the accompanying diagram. Because of the stepless control afforded by this device, it permits



How a variable resistance and a switch or push-button may be employed to regulate the speed of a television scanning-disk motor

variations of speed in fractions of a revolution per minute. A push button is also introduced for the purpose of momentarily speeding up the motor when bringing the disk into synchronism."

This arrangement is in keeping with that employed by Dr. Alexanderson in developing his television system, who says: "We took a standard motor made for household use and manipulated its speed by an electric hand control. With a little practice and co-ordination between the eye and the hand, it is possible to hold the picture in the field of vision as easily as one steers one's car down the middle of the road."



Acme

This radio receiving set and loudspeaker was demonstrated recently at a German exposition held in Berlin. With the tiny loop aerial shown at the left, long distance reception is claimed. No definite details are available

B. C. Forbes' Newest Book

HOW TO GET THE MOST OUT OF BUSINESS

Sent for Seven Days' Free Examination

WHY THIS BOOK

This book, drawn largely from intimate contact with nationally-known men of affairs, offers suggestions on how to get the most out of business.

The "most" what? What you really want to get.

Money? Yes and No.

B. C. Forbes knows millionaire and multi-millionaire failures, men who have miserably missed out in life, men who have followed trails leading to pelf and power but also to disillusionment, unhappiness, remorse.

He knows other men of affairs who, while winning equally as much money, have won genuine success—friendships, reputation, influence, contentment, true joy in living.

Material success is not true-blue success unless it brings mental success. Too often financial success is pursued at the cost of mental success. And, tragically, such chasers usually do not have their eyes opened until they begin to hear the grave a'calling them.

An enthusiastic, joyful, vigorous, zestful life is not incompatible with financial success. It makes, rather, for financial success if the right signposts are followed.

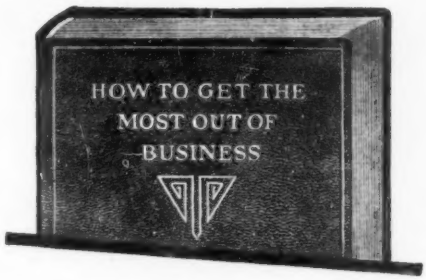
This book draws attention to these signposts.

It doesn't draw illustrations from the dead past but from the living present, from the careers and the home-brewed philosophy of men known throughout the world of finance, industry, commerce, from the experiences of men wrestling with the same difficulties and problems as beset the reader.

The pace to-day is so swift, the battle is so strenuous, concentration is so closely focussed, the immediate objective so engrossing that signposts, danger signals, are liable to be overlooked—and then the goal reached turns out to be the wrong goal, a goal only of disappointment, bitterness, wormwood, gall.

And it is all so unnecessary!

The pages of "How to Get the Most Out of Business" may induce some of the busy men for whom they are primarily written to *Stop! Look! Listen!* in time to steer their course at least a little more effectively along the paths producing the most satisfying rewards and leading to that brand of success which yields joy and causes its possessor to radiate joy.



What Some Reviews Say

"The readers will find many of their problems identical with those presented by the author of this neat little volume. The experiences are taken from the actual business life of today and readers will at once see themselves reflected on the printed page."—*Raleigh, N. Y. Times.*

"He (B. C. Forbes) points the way in stimulating vim to the right objectives—the book is liberally sprinkled with the epigrams that have made FORBES' name famous."—*Boston Globe.*

"Every phase of professional and business life is set forth for the guidance of those who are seeking success."—*Boston Evening Transcript.*

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We shall gladly allow you to examine "How to Get the Most Out of Business" for seven days. Return it, at our expense, within seven days after you receive it, or remit $2.50 as payment in full. The option rests with you. You will be the sole judge of the book's value to you.

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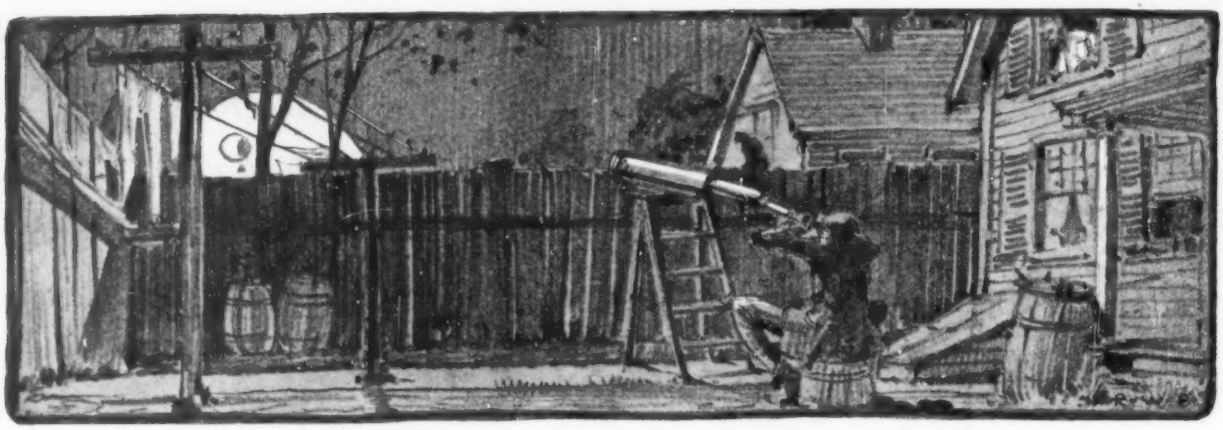


The Back Yard Astronomer

A Department Devoted to Interests of the Amateur Telescope Maker

G. F. HOFFERBERTH, 49 Birchwood Avenue, Dayton, Ohio, who sends in pictures of an especially trim looking telescope of the double forked type described in "Amateur Telescope Making" (new edition, page 26) writes as follows:

"I send prints of a reflector which I have recently completed. The mirror is six inches in diameter with a 48-inch focal length. One of the outstanding features of this design is that the tube with all of the optical parts can be removed from the yoke in a few minutes and taken indoors for protection. This I find is a great convenience as I have no housing, and one feels much better with this part of the telescope indoors.

"The yoke and base are made of one and three-quarters by three-inch birch, glued and screwed together, and the whole is covered with spar varnish. This construction is very strong. However, it is not so heavy that it can not easily be moved from place to place if necessary, and with a little care in placing, I find it to be very steady.

"I think the most interesting part of this work, other than the star gazing, is making the mirror. This, although tedious, is interesting from the very start, and one soon loses all of the fear he ever had about working glass. Even the testing with the knife-edge, while trying upon the eyes, has its great reward when the telescope finally is tried on the Moon or stars. I expect to essay a 10- or 12-inch mirror soon."

With this issue we at last announce the publication of a second and revised edition of the SCIENTIFIC AMERICAN instruction book "Amateur Telescope Making." The word "revised" is, however, much too mild, for the book has been considerably more than doubled in length, now consisting of 286 pages, instead of 102 as formerly. Virtually all of the matter contained in the first edition has been retained, and thus the beginner may continue to use the book as before—to instruct in making a satisfactory telescope capable of magnifying 50 to 200 diameters without expending more than 25 or 35 dollars for the entire job.

To the elementary instructions by Porter, Ellison, Ions, Pierce and others, much new matter, some of it more advanced, has now been added. Porter adds eight new chapters: a chapter of "wrinkles;" a chapter telling how to adjust the telescope and put it into alignment with the co-ordinates of the heavens; a chapter explaining how a telescope having setting circles is used to find the otherwise undiscoverable show-pieces of the skies; one describing a number of

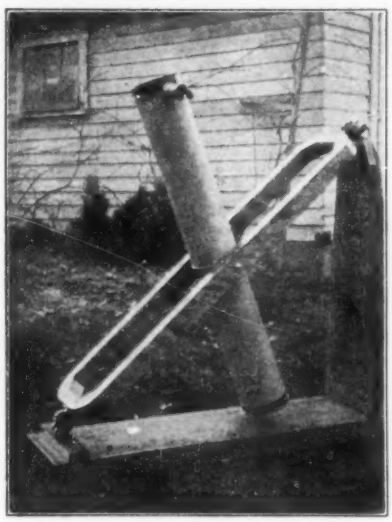
Wide World

A telescope made by G. H. Lutz. The mirror is made of the extremely hard alloy, Stellite, as described in the new edition of "Amateur Telescope Making"

ways to bring the observer indoors away from the cold of winter and the mosquitoes of summer, yet use the telescope to almost equal advantage; practical instructions for making a prism or diagonal; a chapter telling how to make an optical flat or plane surfaced mirror; one on making the Cassegrainian type of telescope, and one which gives complete and detailed instructions for designing and making both the lenses and the metal parts of an eyepiece of high quality and appearance. The instructions for making a flat and a Cassegrainian telescope are virtually unique; they have never been in print anywhere before, in satisfactory detail.

Professor Charles S. Hastings of Yale, who for years designed the curves of the famous Brashear telescopes, contributes to the new volume two chapters on eyepieces, giving the amateur a full insight into the many optical principles involved in eyepiece design, selection and use.

Ellison's treatise on the objective lens has been included in the new edition. This



Mr. Hofferberth's telescope

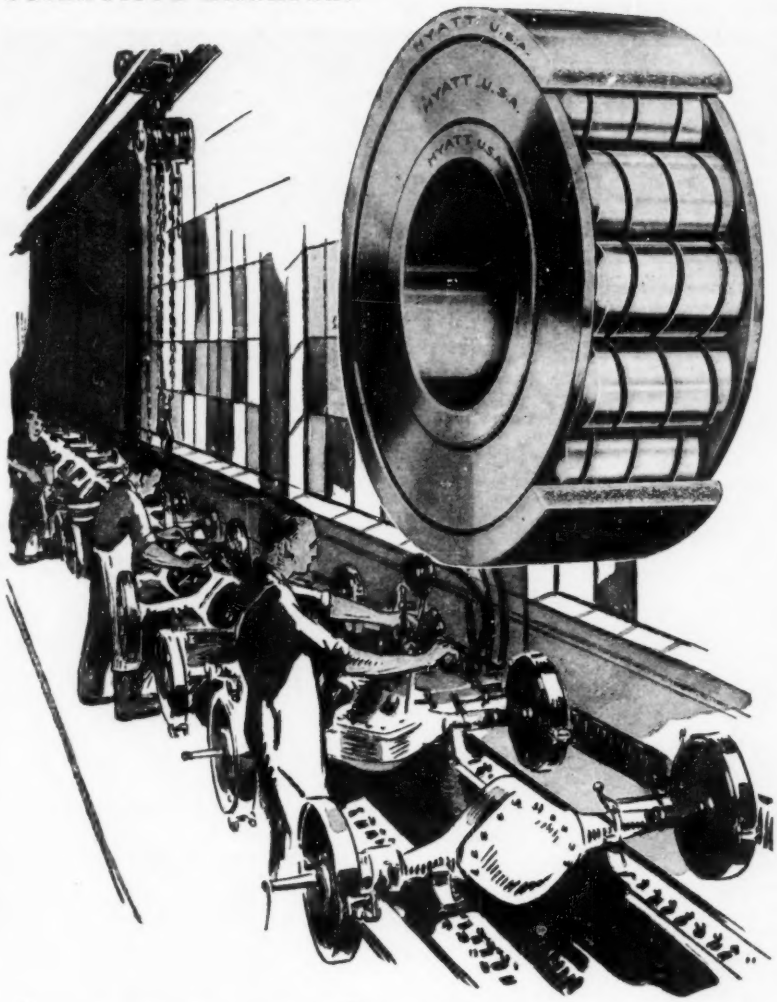
is the first time we have emphasized the refractor as a suitable outlet for the mechanical instincts of the advanced amateur. There has been a small but steady demand, during the past two years, for these instructions and we therefore obtained from the Rev. Mr. Ellison a complete revision of the theoretical part of his original treatise on the objective lens. No treatment of the subject even approaches that by Ellison in length and usefulness.

Silvering has been a stumbling block for the average amateur, and we confess that the instructions contained in the first edition of "Amateur Telescope Making" were not sufficiently well rounded to obviate certain mistakes. The section on silvering has therefore been expanded by the addition of six new pages.

Many advanced amateurs wish to construct machines for grinding and polishing their mirrors. Hand work is equally good although more laborious. The new edition contains a thoroughly illustrated section on machines, describing those used by several workers, and reprinting, with the original illustrations, the description by Ritchey of the type of machine he uses for all his work.

A. W. Everest contributes a complete, practical, illustrated section, telling exactly

(*Continued on page* 466)



A message *from* motordom

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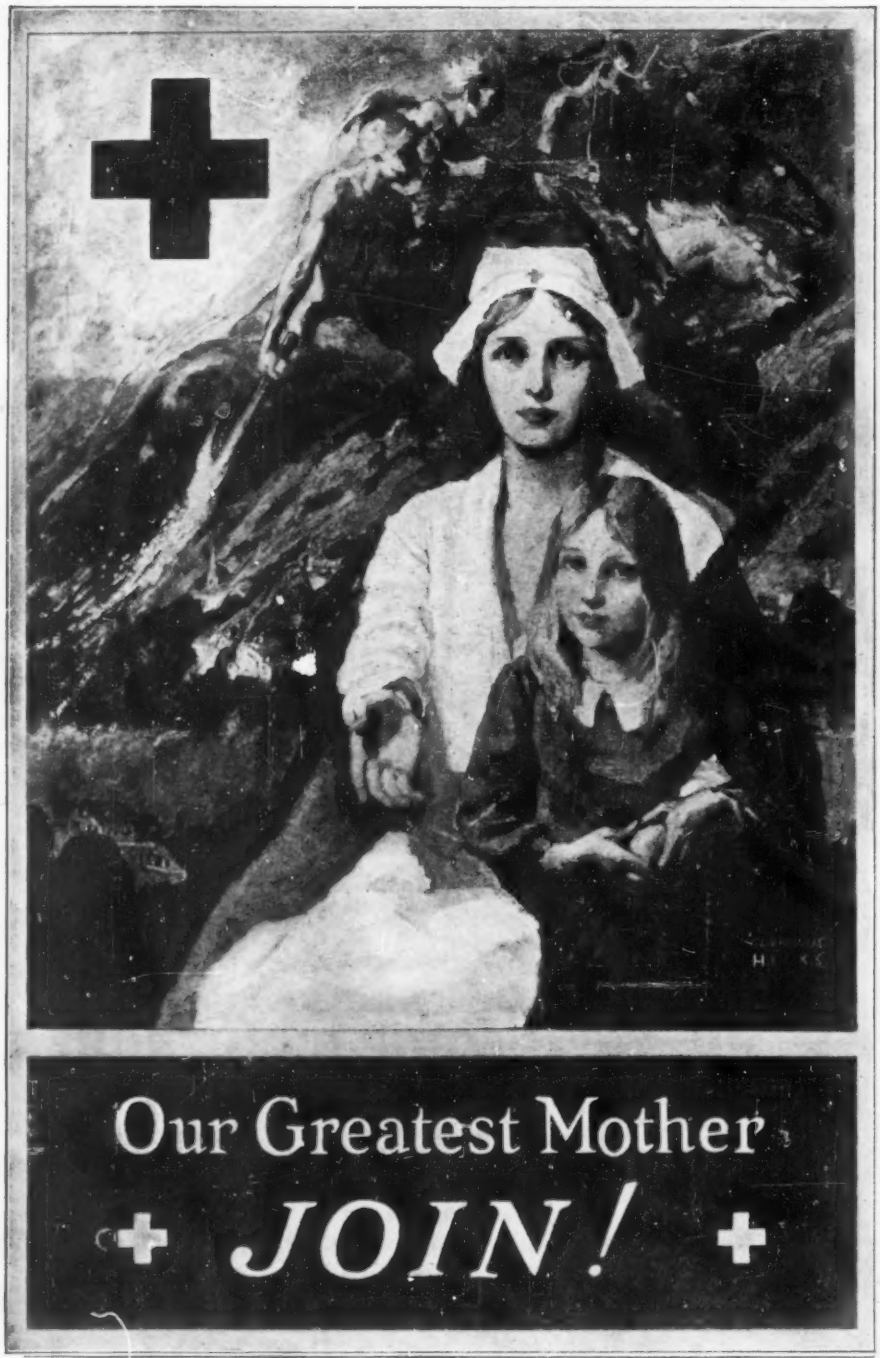

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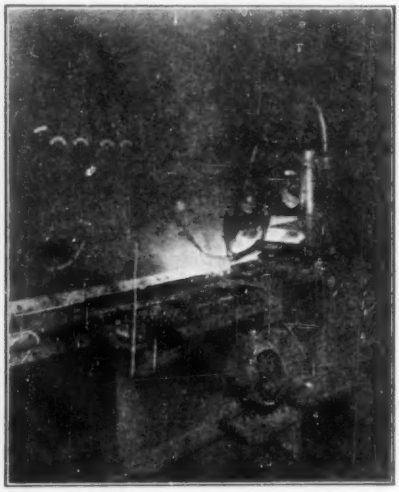
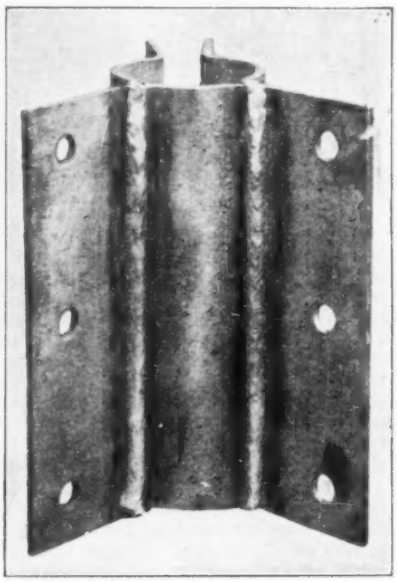
The Scientific American Digest

(*Continued from page* 446)

since details of the process were reserved until satisfactory commercial applications had been worked out. Since then research engineers of the Lincoln Electric Company have perfected a practical welding head for utilizing the Electronic Tornado and have obtained highly satisfactory results.



Above is shown the new device in action welding oil-derrick corner clamps. Its action is entirely automatic. Below is a finished clamp made of three pieces welded together automatically without filler



The electric arc is normally a difficult phenomenon to control. It creates its own magnetic field, and in the passage of the welding current through the parts being joined, creates other magnetic fields of variable direction. The arc, therefore, tends to wander about seeking the path of least resistance, between its own magnetic field, produced by the passage of welding current, and the piece being welded. By super-imposing a strong magnetic field on the arc flame, a control of the arc is established. This control permits the arc to travel through the variable fields with-

out disturbance. The arc is given a gyratory motion of great velocity which also tends to hold it in a straight line.

A new automatic welder, designed to produce oil-well tubular derrick corner clamps, has been constructed to operate on the Electronic Tornado principle. In this machine there are two of the new type welding heads with their electrode holders crossing each other at a sharp angle. This construction is of peculiar interest for with an uncontrolled arc it would be impossible to operate two flames in such close proximity. One would continually blow the other out. With the Electronic Tornado head, however, they work smoothly and without conflict. The clamps produced by this machine are made from three pieces of plate whose aggregate radius bending totals a complete circumference. The assembled pieces from which these clamps are made are fed into the big welder and are carried under the arc in a continuous progression by a chain on which dogs are set at the proper intervals.

This new welder is said to place welds at the rate of better than 40 feet an hour for each head, which is an exceptionally high velocity. No filler rod is used; the arc fuses the various plates inseparably together.

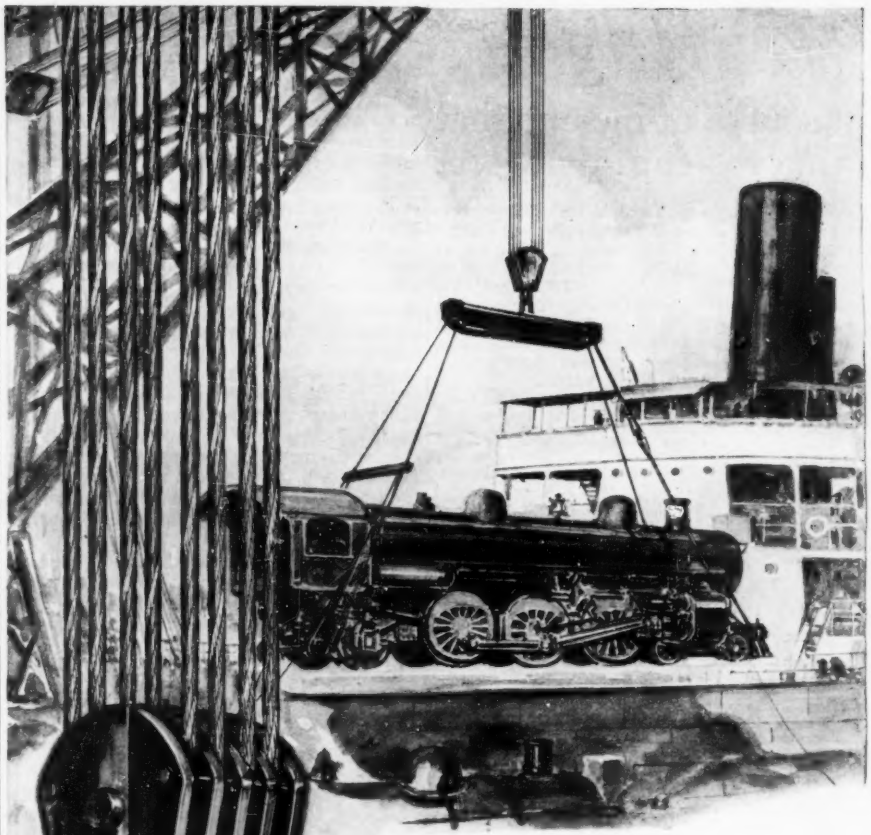
Transparent Steel New Aid to Science and Industry

ON the Kaiserdam in Berlin an unusual exposition of metals used in industry was recently held. At this exposition there were instructive exhibits showing details of manufacture, use, and capabilities of various metals, but perhaps the most interesting was the exhibit of transparent steel.

This invention is the work of Dr. Karl Muller. Two years ago, Dr. Muller succeeded in producing transparent sheets of gold and nickel and today his process applies to steel and any other metal as well. Whereas by the Walz process, aluminum could be made into sheets of a tenth of a millimeter in thickness, by the method of Dr. Muller, steel can be made in sheets of a few millionths of a millimeter thickness, and as transparent as glass. Even the weak alpha rays pass through such a sheet without being diminished in intensity. The thickness of these sheets is so infinitesimal that it cannot be measured directly even by the finest instruments; it is only with the aid of their specific gravity that the thickness of these transparent sheets of steel can be ascertained. Even the hardest metals, when reduced to sheets of this thickness, become extraordinarily elastic. For example, a sheet of such steel, 15 centimeters in diameter, is stretched between two rings, while at a meter's distance is an electric fan which blows upon the steel and agitates it in the same way as when wind blows along the surface of a lake.

In the process of manufacture the sheets are produced mathematically exact and uniform as to thickness without any tears or flaws as might be expected with such extreme thinness. The steel retains its structure unchanged, its only difference being that it is absolutely colorless and transparent.

The properties of transparent steel indicate the tremendously wide scope of its field of application: it transmits light, electric currents, cathode, röentgen, and radioactive rays; it can be magnetised; it



When Locomotives Go to Sea

These immense and powerful rail travelers are so helpless when they put out to sea that they have to be picked up bodily and placed aboard ship.

And the lifting is done with wire rope, the only suitable appliance having sufficient strength and flexibility in small diameter.

Where the work is heaviest, there you generally find that the rope has *one strand of yellow*, the distinguishing mark of Yellow Strand Wire Rope. Imported steel wire and over a half century of wire rope making experience, put Yellow Strand far above the ordinary. And there it has remained for many, many years.

The pioneer manufacturers of Yellow Strand also make all standard grades of wire rope.

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You need a Basline Autowline in you car for emergencies. Made of ¼-inch Yellow Strand wire rope with patented snap hooks for quick attaching. Very strong but small enough to coil flat under a cushion. Ask your accessory dealer.

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Writing

a source of income that many people neglect

MANY people who *should* be writing never even try it because they just can't picture themselves making "big money." They are so awe-struck by the fabulous stories about millionaire authors that they overlook the fact that $25, $50 and $100 or more can often be earned for material that takes little time to write—stories, articles on home or business management, sports, travels, recipes, etc.—things that can be easily and naturally written, in spare time.

Arthur S. Pettit, 536 So. Hope St., Los Angeles, California, is but one of many men and women trained by the Newspaper Institute of America to make their gift for writing pay prompt dividends. He writes:

"You may be interested to know that since enrolling with the N. I. A., I have written several articles for health publications that have been accepted and printed. I am now engaged in the preparation of some articles on church music and on business."

Another of our student-members who tried is Ferd. L. Garcia, 215 East 73rd St., New York City.

"I would like to say I won first prize in the 'biggest news of the week' contest sponsored by the 'World' for high school students. I was gratified to tell Sifton of the Sunday department that I owe much to the training furnished by your good selves. Good luck to you, and thanks!"

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has a minimum of weight; and it is a very poor heat conductor.

The uses to which it can already be applied, even at this early stage of its development, are very significant. In the province of acoustic instruments it promises to produce a new industry; here it can be used as membranes for telephone microphones, medical instruments and in speaking films. It has the advantage of reproducing tones without any distortion, as a result of its infinitesimal mass. As any membrane of measurable thickness does not reproduce very high tones, it is of great value for condensers for microphones and loudspeakers since it reproduces all audible tones—and for that matter, records even those above and below the range of hearing. Further, it is an aid in picture telegraphy because of its electromagnetic light sensitivity.

In instruments to measure pressure and temperature, transparent steel can be used to great advantage as contact membranes, because of its high sensitivity and rapid adjustability.

In the purely theoretical field it can be applied to investigations concerning the atom, such as the relation between light, electricity and magnetism, and studies concerning the cathode, röentgen, and radioactive rays. In laboratories these transparent metal sheets will be used whenever the structure of the metal is to be investigated, for, as has been already stated, the sheets preserve the structure of the metal unchanged; and wherever gases must be kept separated in a container. The I. G. Dye Industry is greatly interested in the property of transparent steel of producing tones of an inaudible wave frequency as it allows the preparation of emulsions which were heretofore impossible (i.e. the mixture of previously indissoluble substances in fluids, forming an emulsion).

Use Hypodermic to Season Meat

SOON the housekeeper may be able to buy her lamb or mutton with the mint sauce already in it, and chicken already flavored with mace and thyme. In France, land of famous cooks and tasty sauces, poultry and meat are now deliciously seasoned by hypodermic injection.

The new method, discovered by Dr. A. Gauducheau, makes use of a principle of physiology and injects sauces and seasoning directly into the blood stream of chicken and other fowl. In this way the flavoring penetrates to all parts of the meat.

"Intra-sauce" is the name Dr. Gauducheau coined for the fluid he uses in this new sort of cookless cookery. He has tried the method on over 200 animals, using all kinds of poultry, and sheep and pigs.

In addition to flavoring, coloring matter may be introduced in the same way to get an even hue throughout the meat, or different parts may be flavored or colored differently. Lean meats may be enriched by injection of lards or oils. For this purpose melted butter has been found the best fluid.—*Science Service.*

Huge Concrete Smoke Stack

ERECTION of a monolithic concrete chimney, 301 feet 6 inches high, the tallest in the Chicago industrial district, has just been completed at the Buffington, Ind., plant of the Universal Portland Ce-

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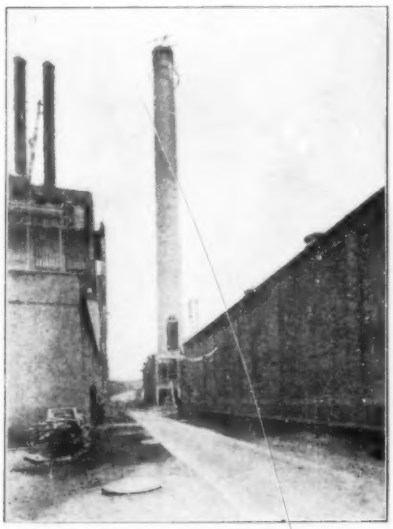
ment Company. This chimney will eliminate a battery of small stacks now in use on the burner building of one of the mills at the plant. Powerful flood-lights playing on the chimney will make it a landmark for night flyers and it is being listed as such with the Department of Commerce.

The chimney is built in connection with waste heat boilers and the most improved type of graded resistance Cottrell precipitator, which will eliminate a high percentage of dust from gases before they pass to the chimney.

The chimney is 26½ feet in diameter at the bottom and 17 feet at the top. The



The monolithic concrete smoke stack that is 301 feet, six inches high, recently built in Indiana

walls are 18 inches thick at the bottom and six inches at the top, while the foundation is eight feet thick at the center, and three feet thick at the edges. A fully guarded steel ladder has been constructed on the outside of the chimney in 30-foot sections, allowing resting places enroute for persons climbing to the top.

A single steel form, seven and one half feet high, was used in building the chimney and a seven and one half foot section of concrete was placed every day. The chimney was designed by the engineering department of the Universal Company and the Rust Engineering Company, Pittsburgh, was the contractor.

Romans Used Glass Panes in Windows

GLASS windows are not the relatively modern things they are commonly reputed to be. According to Dr. M. Blaschke, a German ceramic chemist, they were in use in ancient Rome. Most of the panes did not exceed 12 by 16 inches in size, though a few larger ones have been found.

Glass-making, known for many centuries in Egypt, came to Rome relatively late. During the time of Cicero, who died in 43 B.C., glass objects of any kind were rarities, and glass windows were unknown. A hundred years later most households owned some, and by the time the Empire was well established, glass was fairly common. The famous mosaics of the later Empire, notably at Ravenna and Constantinople, were made largely out of bits of glass.—*Science Service.*

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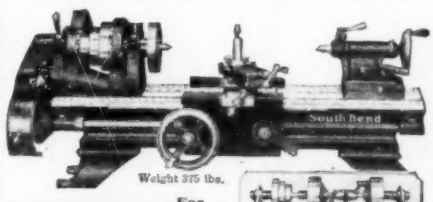

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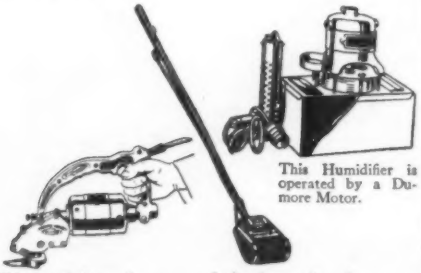

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FRACTIONAL HORSEPOWER MOTORS

The Back Yard Astronomer

(*Continued from page* 461)

how to use the new H.C.F. (honey-comb foundation) lap which he discovered. The use of this lap cuts down the time of polishing a six-inch mirror from six hours to two.

Amateurs who want to take up something really lively will be delighted with Dr. George Ellery Hale's 22-page instructions for making the new spectrohelioscope, a remarkable instrument which will enable them to sit in their garage or other building and actually watch the motion of those vast red prominences on the Sun which often rise 100,000 miles above its surface within the space of a few minutes. The apparatus is remarkably simple and lies within the means and capabilities of the amateur. We amateurs are indeed fortunate to have enlisted the interest and support of so famed an astronomer as Dr. Hale of Mt. Wilson Observatory. —*A.G.I., Tel. Ed.*

The Heavens in November

By PROF. HENRY NORRIS RUSSELL, Ph.D.

At 11 o'clock: Nov. 7.
At 10½ o'clock: Nov. 14.
At 10 o'clock: Nov. 22.
At 9½ o'clock: November 30.
At 9 o'clock: Dec. 7.
At 8½ o'clock: Dec. 15.
At 8 o'clock: Dec. 23.

NIGHT SKY: NOVEMBER AND DECEMBER

MERCURY is a morning star and can best be seen about the 9th, when he is farthest from the Sun and rises about 5 A.M. At this time he is in Virgo, about five degrees east of Spica, and appears about five times brighter than that star.

Venus is an evening star setting about 6:45 P.M. She is far south of the celestial equator and hence less conspicuous than she would otherwise be.

Mars is in Gemini and is a brilliant object. He rises at 7:30 P.M. in the middle of the month and dominates the morning sky. At the end of the month he is less than 60,000,000 miles distant, and planetary observers will be very busy with him.

Jupiter is in Aries, just past opposition, and is the brightest object in the evening sky.

Saturn is an evening star. On the 7th he is in conjunction with Venus at a distance of a little more than two and a half degrees. By the end of the month he is lost to view.

Uranus is in Pisces and comes to the meridian about 8:30 P.M.; while Neptune is in Leo and "souths" not far from 6 A.M.

The Moon is in her last quarter at 9 A.M. on the 4th; new at 5 A.M. on the 12th; in her first quarter at 9 A.M. on the 20th, and full at 4 A.M. on the 27th. She is nearest the Earth on the 27th and farthest away on the 14th. During the month she is in conjunction with Mars on the 1st, Neptune on the 5th, Mercury on the 10th, Saturn on the 14th, Venus on the 15th, Uranus on the 23rd, Jupiter on the 25th and with Mars again on the 29th.

There are two eclipses this month. The first, a partial solar eclipse on the 12th, is invisible in the United States but can be seen shortly after sunrise throughout Europe, excepting Spain, and at other hours during the day across Asia as far as India. The lunar eclipse on the 27th is total and is visible throughout North America. The Moon enters the outer penumbra of the Earth's shadow at 1:25 A.M. Eastern Standard Time, reaches the dark shadow at 2:24; is immersed in it completely from 3:33 until 4:29; leaves the shadow at 5:39, and the penumbra at 6:37. The Moon will be high in the sky and, weather permitting, the eclipse should be well worth watching.

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Learning to Use Our Wings

(*Continued from page 450*)

The Dornier works at Altenrhine in Switzerland are now attempting something far more ambitious. The information available is as yet only of the newspaper variety, but this seems fairly reliable since the description given follow closely the lines of Dornier practice. The *DU-X* will resemble the Dornier *Superwhale*, and will be a monoplane of 400 feet in span. It will be powered with 12 engines of 500 horsepower each, probably arranged in three tandem sets on either side of the hull.

Owing to the huge size of the seaplane, it will be possible to enclose the engines entirely in the wing, thus saving much head resistance. The headroom inside the wing will be over six feet, so that mechanics will be able to work comfortably around the engines, without being exposed to a cold blast of air.

The weight of the *DU-X* empty will be about 20 tons, and it will carry a useful load of fuel, oil, passengers, crew, and baggage of another 30 tons, so that the total gross weight will be about 100,000 pounds. The structure has been designed with extraordinary care and will be entirely of steel and duralumin. The performance estimate is that the maximum speed will be close to 200 miles an hour (this seems unduly high) and the endurance over 20 hours of flight. Any eight of the engines will suffice to keep the giant aloft as long as fuel is available.

The *DU-X* cannot equal the luxury of a modern liner, but it will have very comfortable passenger accommodations nevertheless. The hull will be 130 feet long and wide enough in the cabin for a row of six chairs separated by two aisles. There will be four passenger cabins for the 50 or 60 passengers carried. The kitchen is to be amply supplied with varied foods, and provide facilities for the most exacting cuisine. There will be separate compartments for the navigators, pilots, radio operators, and the rest of the crew. Dornier claims that the *DU-X* will be able to outride waves 15 feet in height, and that the wing structure will be able to withstand pounding just as long as the hull itself.

There is nothing unrealizable in this project. The trial trip will be awaited with interest throughout the world.

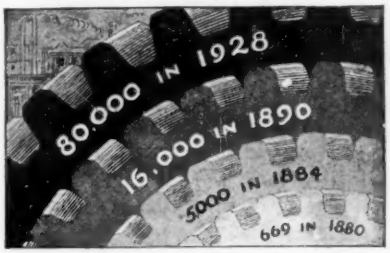
Guiding the Air-Traveler

RECENTLY the Airways Marking Conference met at Wichita, Kansas, to consider ways and means of marking our national airways. A new airway marker called "Aerovane," developed by the Aerovane Utilities Corporation of New York, received instant approval, and is now being installed throughout the country, on the outskirts of many municipalities.

The new airway marker consists of a structural steel pole, six inches in diameter and twenty-five feet in height. Three feet above the steel pole, at the very end of the marker is mounted a wind-cone, or "windsock" as pilots prefer to call it. Six feet below the point of attachment of the windsock is a large arrow, some 13½ feet in length and perhaps three feet in width. This arrow, painted a chrome yellow, has lettered in black the name of the town to which the arrow is pointing. On the tail of the arrow is placed a smaller arrow, painted in white and pointing toward the true north.

Six inches below the arrow is a sign

Roanoke is Growing in High-Gear



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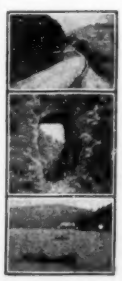
Quite evidently there are facilities in Roanoke that make for unusual industrial prosperity; facilities that you should know about before you pick a location for your new plant or branch warehouse.

Write for the ROANOKE BRIEF. It will give you the complete facts on Roanoke, compiled for quick, easy reading. Plans for Roanoke's future industrial growth are now being prepared by experts in city layout. Now is the best time to plan your move to this fast-growing southern city. When writing, please use your business letter-head. Address: Chamber of Commerce, 217 Jefferson Street, Roanoke, Virginia.

ROANOKE VIRGINIA

Motor through this Scenic Section



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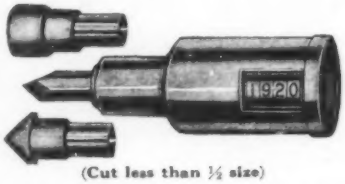

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board, usually eight feet by three feet, carrying the name of the town and perhaps its slogan. Hanging from this board on each side of the pole are circular panels, 42 inches in diameter, which can be rented for advertising purposes.

It is claimed that the arrow can be readily seen, under normal weather conditions, at a height of 3000 feet, and that the lettering designating the town or city is readable at a height of 1000 feet. Provision has also been made for flood-lighting the arrow when desired.

Such a marker has many advantages over random signs placed on the roofs of buildings which may or may not be located with reference to an airway. Safety in aviation depends as much on the provision of such aids as on the flying equipment and

The new airway marker as seen from the ground. At the top is a wind-sock, and below it is an arrow painted with the name of the town

personnel, and it is to be hoped that this marker or similar markers may soon be provided everywhere.

Modern Airports

LIEUTENANT DONALD DUKE is the author of the well-known book "Airports and Airways" and was formerly chief of the Airways Section of the Army Air Corps. His views on the modernization of our airports, expressed in an article in *Air Travel News* are therefore worth serious consideration. Our airports have grown up in somewhat haphazard fashion from the old type landing field, surrounded with a number of hangars whose sole facilities were shelter for the airplane. They had large swinging doors to provide entrance and exit for the planes.

If the public is to be permanently attracted to flying, the airport and the airport hangar must be made convenient and attractive. Municipal airports throughout the United States have abandoned the practice of erecting hangars on their properties, and quite rightly so, since this meant an additional burden on the taxpayer. They now lease hangar sites to the operators. Unfortunately, in such leases, uniformity of

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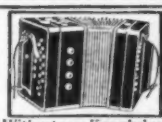

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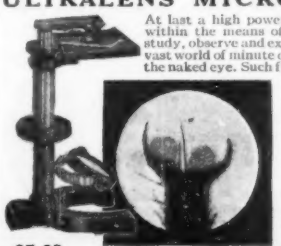

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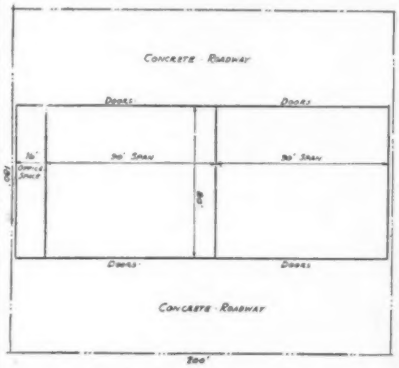
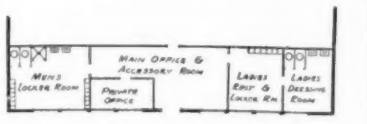
construction and a certain level of utility and appearance have not been required. Hence the sad experience of many cities in seeing an ill assorted, incommodious group of sheds disfigure their airport.

In the appended sketches, Lieutenant Duke sets forth his valuable ideas of what hangars and hangar arrangements should be. The hangar should have a front of brick-facing with windows resembling a modern store in appearance. It may be built in single units of 90 foot span, or in double units depending on the needs of the operating organization. Sufficient light should be provided through doors along the sides of the hangar. Steel or wood trussing, adequate ceiling so that heating is possible, and proper drainage are other requirements.

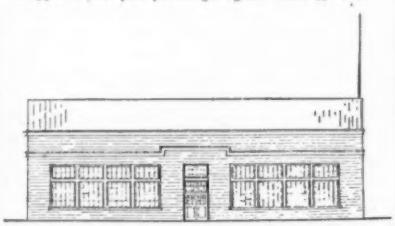
Between hangars of this type there should be a 100 foot concrete apron where planes may be warmed up and adjustments made.



Plot plan showing the proposed size of leased areas. Scale 1"=30'.



Suggested floor plan for hangar office. Scale $\frac{1}{8}$"-1'-0"



Office elevation. Scale $\frac{1}{8}$"-1'-0".

Plans for a modern hangar and airport offices. See text herewith

This apron affords shelter from wind, lessens the danger of damage to the propeller by the picking up of small stones, causes less noise, eliminates congestion on the flying field and generally improves matters.

The tracts of land leased to operators should be of ample size, say 180 feet by 200 feet. The entire front of each hangar, facing the flying field, should be partitioned off as shown on the plan to give the maximum convenience to patrons and operators alike. Glass windows in the front of the hangar, and roof gardens for summer use will add to the comfort and pleasure of patrons. Lieutenant Duke's views are eminently sound and much of the success of passenger transportation companies will depend on the airport and hangar facilities.

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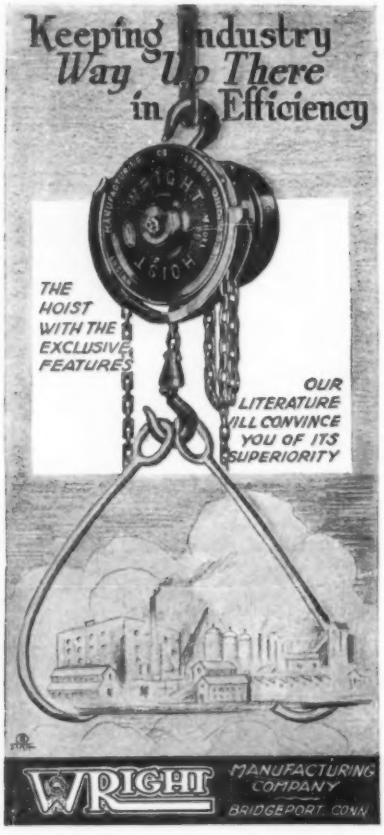
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Industries From Atoms

(*Continued from page* 454)

in many instances capable of extreme deformation. They must not be affected by mouth conditions nor should they oxidize greatly when molten, in red heat, or during soldering operations. In addition to physical specifications, color demands must be met. One firm alone manufactures 11,553 standard stock articles of precious metals, taking into consideration formulas, finenesses, grades, colors, gages, lengths, sizes and weights. If the special demands were taken into consideration the number would be in excess of 25,000.

The demand for dental golds has increased in direct ratio to the practice of dentistry. Contrary to general opinion, gold alloys are being used in increasing amounts, although in better dentistry they are concealed when possible. Dental gold sales amount to at least 25,000,000 dollars annually. If the value of gold used in a restoration amounts to a dollar, the dentist's fee for his materials and time amounts to at least ten dollars. Thus dental fees for gold work alone total at least 250,000,000 dollars annually.

Trichlorethylene Finds Wide Application

PROMINENT among the newer solvents which are daily replacing the older solvents in new industrial applications is trichlorethylene, CHCl. CC_2. It is a pleasant-smelling liquid of 1.47 specific gravity and boiling point of 87 degrees, Centigrade.

Trichlorethylene does not attack the common metals even in the presence of moisture, and there is no difficulty in constructing equipment for its use at a reasonable cost. It is a very rapid worker, and may be used for the extraction of either moist or dry materials. In comparison with benzine, in the same apparatus, it yields a larger output in a given time. It is non-inflammable and has a low latent heat of evaporation. It is heavier than water, and therefore may be kept under water to prevent evaporation.

Trichlorethylene is used to-day in large quantities in the extraction industry. Its purity makes possible the extraction of delicate fats without damage. It is also largely used for de-greasing. It is used for the solution of resins, tarry and bituminous products, India rubber and many organic substances, sulphur and phosphorus; in the preparation of rubber-cements; and in the varnish, paint and lacquer industry.

Its valuable cleansing properties have led to its extensive use for dry-cleaning, where its non-inflammability is greatly appreciated; also to its incorporation with soap in laundry and scouring preparations.

Chemist Combats Corrosion of Collapsible tubes

COLLAPSIBLE metal tubes are used in almost incredible numbers as containers for retail quantities of tooth paste, cold cream, shaving cream, and medicinal or cosmetic preparations in great variety. Many of these preparations are alkaline and must be packed in tubes of greater chemical resistance than aluminum. Lead and tin are extensively used, but these metals are heavy in comparison with aluminum—a pound makes fewer tubes, and

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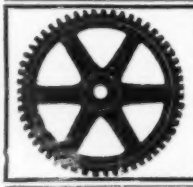
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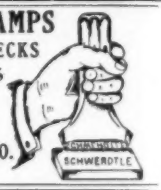

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tin costs much more than aluminum per pound.

The average person would not think of shaving cream as a sufficiently corrosive material to destroy an aluminum tube, but, at least as far as those brands which consist principally of soap are concerned, such is the case. Manufacturers have discovered, however, that the addition of small amounts of sodium silicate to the shaving cream prevents this objectionable action, without affecting the quality of the product.

Silicate P's and Q's speculates on the cause of this protective action of silicates in toilet preparations. "This idea of a protective film is not supported by anything we have been able to see on the protected metal and it would also seem necessary in order to form the film that the contents of the tube should have a mobility which shaving cream does not possess. It seems to us rather more likely that the colloidal silica lays hold of the alkali in a way to render it less active, and that the effect is thus a general one which comes into play when the product is in use as well as when it is in storage."

Propane and Butane Used to Enrich Manufactured Gas

CONSIDERABLE interest is being evidenced by the gas industry in the possibility of using propane and butane gases as enriching agents in the carburetion of water gas. Propane and butane are obtained in large quantities as by-products in the production of natural gas gasoline, and can be liquified and shipped in pressure cylinders.

Tests that have been made show that this proposal is technically sound. In fact, there are many advantages claimed for it over the present method of enriching water gas by the use of oil. These advantages include a decrease in the consumption of enricher per unit of gas due to lower condensation in the distribution system, decreased purifying costs, saving in the expense of carburetors and superheaters, and fewer complaints due to obstructions in the lines caused by the deposition of naphthalene.

An editorial writer in *Gas Age-Record* says that the big question seems to be whether the price to be charged for propane and butane will allow its economical application to gas manufacture. If it is not used in gas plants, he points out, it probably will be used as a competitor of manufactured gas, particularly in industrial utilization.

Aluminum Plating Successful At Last

SUCCESSFUL electro-deposition of aluminum on metal, long a problem for science, has been perfected by D. B. Keyes of the University of Illinois. By means of this aluminum plating, billions of dollars may be saved, he predicted before the Institute of Chemistry recently.

"The housewife," said Professor Keyes, "will now be able to have her kitchen utensils look like the old aluminum variety and yet have the strength of steel. They will be cheaper and will have none of the disadvantages of denting and knicking which now are so common.

"In the production of power there is a large loss in the discard of 'economizer tubes' which can be avoided by using aluminum-coated steel, hitherto an impossibility.

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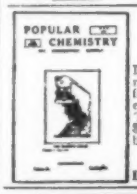

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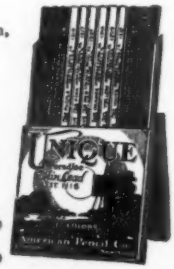

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"This has been done at the University of Illinois by a new and different method of electro-plating. It is impossible to electro-deposit aluminum from a water solution. The new method makes use of organic metallic complexes that are liquid at ordinary temperatures or at temperatures slightly above."

Professor Keyes expressed the belief that this new method will have universal application to all metals. "It should be possible," he said, "to electro-deposit any metal desired, even though it is impossible by the old technique."

New Ford Contains 110 Rubber Parts

SINCE "Henry made a lady out of Lizzie," the once familiar nickname "Tin Lizzie" has fallen to the discard. The country certainly needs a new nickname to embody the affection, admiration and amusement which Model A is bound to inspire before its course is also run. Possibly the ingenuity of rubber technologists in developing their product to suit a myriad uses in the new Ford will eventually inspire a nickname in which rubber replaces "tin," for there are a hundred and ten rubber parts in the Model A Ford. A great many of these function solely to protect the car and its occupants against the action and noise of road shocks and power vibration.

Wherever there is a possibility of a squeak developing, where frame members are joined, or where the body is attached to the frame, rubber anti-squeak parts have been designed and installed. Engine mountings of the car are cushioned in rubber and the following parts each have an anti-rattler device of rubber: spare wheel carrier support; steering column support; steering gear control rod; gas tank cable support; carburetor adjusting rod on the dash board and the front belt rail.

The windshield, windows and doors are fitted with rubber weatherstrips to keep out driving rain and wind and the entire ignition system is insulated with rubber. The steering wheel is finished in hard rubber, which is also utilized in the manufacture of a number of the parts. Fordite, used in the door bumpers and other parts, is a high grade rubber composition material.

Straw, Formerly Burned, Becomes Basis of New Industry

SHOW the chemical engineer something that is going to waste and he will not sleep soundly until he has figured out some way to produce a valuable product from the refuse. Such was the inspiration for a straw insulating board which has come into wide and increasing use for building construction as an outside sheathing, a substitute for plaster lath, et cetera.

The chemical engineer observed great quantities of wheat straw being burned

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every year because it is too resistent to decay to be assimilated by the soil between harvest and sowing time.

Since most cereal areas are devoid of forests and must transport lumber from distant places, it occurred to him that the straw might be made into boards. The fibers of straw are cemented together by Nature in long filaments which can be separated, after softening the binding material, by cooking for a few hours.

That portion of the straw which is rendered soluble by the digestion acts as a strong binder and water-proofing agent, so that the mascerated fiber has excellent felting properties together with the cementing characteristics necessary to form a strongly interwoven mass. The proportion of air cells in the finished straw board is high so that the board weighs only 600 pounds per thousand square feet; since the board is seven-sixteenths of an inch thick this is equivalent to 16½ pounds per cubic foot as compared with eastern white pine which weighs 24 pounds per cubic foot.

More recently additional research work has pointed the way to the production of valuable by-products from the liquor from the digestion operation. These liquors are susceptible to bacterial action and, under proper control, acetic acid, lactic acid, various alcohols, and similar products may be obtained by fermentation.

Golden-rod Not to be Sneezed At

VICTIMS of hay fever may be excused for not attaching appropriate dignity to the lowly golden-rod as the official floral symbol of this country. This abundant wild flower bids fair to assume new dignity, however, as the result of Thomas A. Edison's researches on his private farm in Fort Myers, Florida. In his efforts to find among the wild plants of the United States a source of rubber, he has sown the seeds of 1400 wild plants. So far 80 of these have been found to contain rubber. At least 12 have been found to grow on the cotton plantations of the south without danger of harm from frost. Golden-rod, which will grow on the soil of almost every state, has been found to be one of the best sources of rubber among native wild plants.

Converting an Evil Smell to Dollars

IN a paper presented before a recent meeting of the Canadian Engineering Institute, W. H. DeBlois disclosed interesting statistics on the amount of sulfur contained in gases discharged in smelting plants of the Dominion. According to him, 1500 tons of sulfur are going to waste each day from Canadian smelters. The possibility of recovering a part of this for commercial use is of particular interest to Canada with its import balance of approximately 200,000 tons of sulfur valued at $3,000,000 per year.

The imported sulfur is used largely by the pulp and paper mills. It is now proposed to produce liquefied sulfur dioxide at the smelters for use in the paper mills. According to Mr. DeBlois, the first effort to recover any of the sulfur from these gases was made by the Mond Nickel Company at its Coniston, Ontario, plant, where the recovered sulfur was intended for use in the manufacture of sulfuric acid. The attempt was a technical success, but no market was nearby for the acid produced, so the tendency lately has been t[illegible]ward the liquefaction of the sulfur di[illegible]

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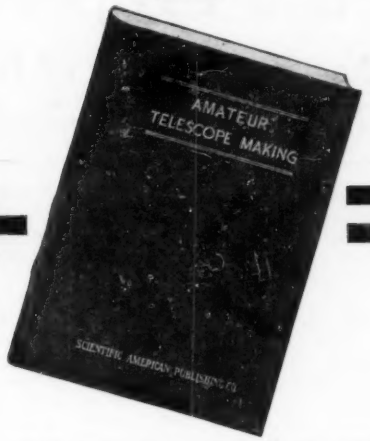

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Commercial Property News

A Department of Facts and Notes of Interest to Patentees and Owners of Trademark Rights

The Court Learns About Hooks and Slices

COURTS of law and equity have done some remarkable things. Under certain circumstances they have told a man how much money he was going to get, whether he was going to continue being married or not, and where he was going to spend the next few years; they even have been known to predict the date of a man's death.

Up to now, however, they have not ventured to explain why an average amateur golf player does not hit a ball better than he does. That was something that seemed beyond even the powers of a Federal judge to fathom. But in a patent case the queerest sort of things are likely to develop, so when Arthur F. Knight and the Horton Manufacturing Company sued the Union Hardware Company for infringement, Judge Thomas of the United States District Court for Connecticut found out the whole secret.

Knight is the man who invented and patented, in 1910, the steel shaft golf club which is in such wide and growing use today. He also owns seven eighths of the Horton Manufacturing Company, of Bristol, Connecticut, which, as the sole licensee under the patent, manufactures the shafts. Naturally, when the Union Hardware Company began to make and sell steel shafts, there was a suit for infringement.

Prior to his invention, Knight declared, golf clubs were constructed by securing the head of the club to a wooden shaft, usually of a highly elastic wood such as selected seasoned hickory, tapering to a comparatively small section near the head and much stouter at the handle end. Hickory has been uniformly preferred because it is hard, tough and supple, the suppleness controlling the rebound of the head after impact with the ball and adding to the distance of the drive.

"The patentee claims to have discovered that there is an inherent objection in a hickory shaft," says Judge Thomas, "because the wood is fibrous in nature and, therefore, offers but slight resistance to torsional strain, in consequence of which the head of the club yields in a line circumferential to the axis of the shaft, or, in other words, the blow produces a strong torsional strain, which twists the hickory shaft. This torsional element is alleged to be highly objectionable since an angular rebound causes the ball to deviate from the direction of impact, so that, unless the golf player knows how to offset this inherent tendency of the club, his play will be uncertain and irregular.

"In order to overcome this tendency or defect, the patentee seeks to provide a construction which is practically torsionless by making the shaft of steel tubing, preferably, hardened and tempered to give as great suppleness as desired. The tubing as described in the specification may be cylindrical, although a tapered or stepped tube is preferred. The patentee furthermore states that high carbon steel is preferred in making the tube and that it may be tempered so as to increase the resistance to torsional strain. The tube may be case-hardened with improved results, or nickel steel may be used, the latter being known to be of high torsional resistance."

The court shows that golf clubs with metal shafts were known long before Knight entered the field. He cites the Grant British patent issued in 1892, describing "a golf club shaft made of steel or other elastic metal, either hollow or solid, or partly hollow and partly solid." He also cites the Hornsburgh British patent of 1894 covering a tapered steel shaft and the Bullows British patent of 1896 for a tubular metal shaft.

"Of course it must be held," Judge Thomas continues, dismissing the suit, "that the patentee was the first to provide a torsionless or substantially torsionless tubular metal shaft or golf club in order to enable a player to make his game more uniform and with which even a beginner may learn to play golf fairly well, so that the claims in suit are valid if read with the limitations imposed upon them by the patentee who responded to the Patent Office rejection by stating that the claims 'cover a torsionless structure of steel tubing,' without which limitation the patent could not have been issued. But they are not valid without these limitations or if it is attempted to broaden their scope so as to include any tubular metallic shaft. The limitations read into the claim make them valid, but in such case the defendant does not infringe the claims in suit because defendant's shaft possesses torsionless characteristics."

So now you know why it is you have not been able to play better golf.

Sometimes inventors are ahead of the times. Edward Lauste, shown above, may have been one of these. An early experimenter in the field of "talking motion pictures," he lacked capital to exploit his inventions. His patents expired soon after the World War. Now the art has caught up with him, but he has no rights from which to profit

Lincoln and Invention

INVENTIONS and patents have claimed the close attention of nearly every American whom history acclaims as great—Washington, Franklin, Jefferson—all the leaders of the past. Take Abraham Lincoln for example.

On May 22, 1849, Patent Number 6469 was issued to Lincoln on a device for buoying river boats over shoals, according to Joseph Rossman, Assistant Examiner in the Patent Office. The invention provided adjustable buoyant air chambers, with metal tops and bottoms, and the sides made of India-rubber cloth or other waterproof fabric. A number of them were placed at each side of the boat, and they could be raised or lowered by a series of ropes and pulleys. When the chambers were lowered and filled with air they expanded and buoyed up the boat and enabled it to float off the sand bar.

The entire specification of the patent, on blue-gray paper, is in Lincoln's own handwriting, although he used a printed blank form for the petition and oath, sworn to before a Washington justice of the peace. Although Lincoln himself was a good lawyer, he retained a patent attorney, Z. C. Robbins, to prosecute the application. Robbins amended the single claim of the application once before it went to issue. A model, now on exhibition in the National Museum, accompanied the application, as well as the fee of 30 dollars. Lincoln was a practical man, and the fact that he went to the time, trouble and expense necessary in developing his idea indicates that he probably expected something to come of it.

Ten years later he still was interested in inventions. His funds being low, he tried lecturing and chose "Discoveries and Inventions" for his subject. This lecture he delivered in Springfield, Illinois. It first appeared in print, however, in the *Sunset Magazine* in 1909.

"Man is not the only animal who labors," he told his hearers, "but he is the only one who improves his workmanship. This improvement he effects by discoveries and inventions. His first important discovery was the fact that he was naked; and his first invention was the fig-leaf apron. This simple article, the apron, made of leaves, seems to have been the origin of clothing—the one thing for which nearly half of the toil and care of the human race has ever since been expended."

Throughout his career inventions interested him. When he was President, Christopher N. Spencer, inventor of the first repeating rifle, brought one of his rifles to Washington. He explained its operation to Lincoln, and the next day Lincoln and Spencer walked to the spot where the Washington Monument now stands and set up a target. Lincoln made several good shots and found the new rifle satisfactory.

Through his influence about 10,000 were ordered. About 20,000 altogether were issued to the Union Army, and they proved effective in a number of important battles including Gettysburg.

When John Ericsson submitted his plans for the *Monitor* to the Union admirals, they were not favorably received. It was only when Lincoln exerted pressure that the freak invention was accepted. The *Monitor's* saving of the remnants of the Federal fleet is a matter of history. Once again Lincoln had justified his interest in inventions.

Jacks for Queens

THE birth of invention is the death of chivalry. If the Queen of England today found a muddy gutter facing her, there would be no need for a Raleigh to spread his cloak. The Queen would be wearing galoshes.

There has been one situation, however, where traveling gallants have been wont to aid queens on the road. This occurs where a lady motorist has a flat tire and tries in vain to jack her car up so the tire may be changed. It is a messy job and no lady likes to do it.

Now, however, in France, an automatic jack operated from the instrument board of the automobile has been perfected, according to advices received by the Automotive Division of the Department of Commerce. A jack for each wheel is situated on the axle. It is a short steel cylinder, the lower part of which normally is level with the jack block and the axle, so as not to decrease the road clearance. A double telescopic piston in the cylinder allows a relatively long stroke for the lifting plate. All milady does is push a button on the instrument board, the block descends to the ground, and the wheel is lifted.

Thus do inventions add to women's independence.

Commercial Prints and Labels

AS one item of its service, the Ervin Press Corporation cleans neckties. As a means of calling attention to this service, it has devised a print comprising a diamond-shaped outline within which are several business slogans or advertisements including, "Did you ever have your ties cleaned? They come back with all their original respectability, 15 cents each." A pictorial representation of several ties appears on the print.

This print they sought to register in the Patent Office, calling attention to the provision of the copyright statute which reads, "No prints or labels designed to be used for any other articles of manufacture shall be entered under the copyright law, but may be registered in the Patent Office." This clause, they urged, should be interpreted as meaning that the print or label itself may be regarded as the article of manufacture contemplated by the Act.

It was no use. Assistant Commissioner Kinnan denied registration, saying, "This section of the copyright law was enacted as long ago as 1874 and for almost a third of a century has been consistently construed by the various officials of this office as requiring that the print shall be designed for an article of manufacture other than the print itself and other than those 'connected with the fine arts.'

"While the construction heretofore placed on the law relating to registration of prints would not preclude a different view in the instant case if clear error were made to appear in such former construction, yet the fact that such interpretation has been uniformly followed for this long period during which the statute has been in force is persuasive that such view is correct.

"The applicant contends that its print describes neckties, but with this contention I am unable to agree. The print is clearly an advertisement of service and the conclusion of the examiner as to this point is believed to be sound."

Trademarks in China

THE Republic of China, with four hundred million inhabitants and far too few manufacturers to begin to supply them, offers an attractive market for American exporters. Success, however, depends in no small measure on knowing the tastes, ideas and habits peculiar to the Chinese. Only one tenth of the Chinese can read; the others buy goods through recognizing some particular "chop" or trademark. It is important, therefore, Dr. Julius Klein, Director of Foreign and Domestic Commerce points out, that trademarks for use in China be chosen intelligently.

"If your trademark features the picture of a dog, you will do well to change it in China, for the dog, to put it mildly, has no high place in Chinese regard. Still worse would be the error of a manufacturer who stamped a rabbit on his wares, and if by chance he should choose the turtle, inoffensive enough to our western ideas, his product would be condemned at a glance.

"One American canned-milk company, in its China advertising," he says, "made the mistake of emphasizing the use of its product with coffee and tea, although the Chinese know nothing about coffee and would no more think of putting milk or cream in their tea than Americans would think of putting it in lemonade. Another American milk company made a big hit with the Chinese by showing in its trademark an infant labeled "It's a Boy" thus appealing to the universal desire for, and pride in, a son.

Dr. Klein mentioned several instances in which large markets have developed in China from unexpected causes. An American manufacturer noted that there was an extraordinariiy large sale in China for the small hot-water bags usually known as "neuralgia bags." Chinese girls were buying these to use as hand warmers in their muffs, and to hold against their faces to give them red cheeks.

New Uses for Old Methods

YOU might think it a simple matter to attach a shelf support to the porcelain coated steel lining of a refrigerator. Appar-

Patents Recently Issued

Classified Advertising

Advertisements in this section listed under proper classifications, rate 25c per word each insertion; minimum number of words per insertion 24, maximum 60. Payments must accompany each insertion.

Official copies of any patents listed in this section at 15c each; state patent number to insure receipt of desired patent copy.

Pertaining to Aeronautics

AEROPLANE LANDING AND LAUNCHING DEVICE—Primarily designed for landing and launching aeroplanes in comparatively congested areas, the planes being landed and launched without touching the ground. Patent 1680473. O. Parker, Bentonville, Ark.

HELICOPTER—Can be operated to rise from the ground and descend in a substantially vertical direction, may be propelled at relatively great speed, and accurately controlled. Patent 1681019. H. C. Stewart, Webster, Ky.

Pertaining to Apparel

ARTICLE OF HEADWARE—A cap, in which is embodied an outer band forming a finish for the crown, at its edge, and at the same time a head-contacting size band. Patent 1681006. P. Merton, Park Ridge, N. J.

Chemical Processes

METHOD OF PREPARING RUST-RESISTING IRON AND STEEL PRINTING PLATES—For readily receiving the photographic, or transfer coating, in lithographic work, by washing one surface with a 10% solution of hydrofluoric acid, washing off the acid, and thoroughly drying. Patent 1681849. R. Fritsche, 138 Centre St., New York, N. Y.

Designs

DESIGN FOR AN ELECTRIC-LIGHT FIXTURE—Patent 76140. W. Klehr, c/o E. F. Caldwell & Co., 36 W. 15th St., New York, N. Y.

DESIGN FOR A DRESS—Patent 76121. Katherine E. Burns, c/o Franklin Simon & Co., 38th St. & 5th Ave., New York, N. Y.

DESIGN FOR A VENTILATED RODENTPROOF CLOTHES HAMPER—Patent 76017. M. Halpert, c/o M. H. Metal Product Corp., 1154 Flushing Ave., Brooklyn, N. Y.

DESIGN FOR A STOCKING—Patent 76025. R. Lefi, c/o Lefi & Co., 305 5th Ave., New York, N. Y.

DESIGN FOR A TEXTILE FABRIC—Patent 76029. W. H. Mayer, Jr., 260 Green St., New York, N. Y.

DESIGN FOR A RADIOCABINET—Patent 76185. O. P. Fritchle, 4618 Kanmore Ave., Chicago, Ill.

Electrical Devices

CUT-OUT AND PLUG—Wherein a special structure will prevent anything but a correct fuse plug from being used, when plugs are changed or new ones provided. Patent 1680969. W. P. Briggs, Municipal Bldg., New Bedford, Mass.

GROUND FITTING—For use in connection with

polarized service, for grounding the neutral, or so-called white wire, on a water pipe or the like, without solder or adjusting straps. Patent 1681129. A. M. Nugent, Unionville, N. Y.

POWER-FACTOR CONTROL FOR POWER SYSTEM—Whereby the power factor of an alternating current power system having a synchronous motor load may be maintained at unity or 100%, with automatic regulating means whereby the above advantages may be accomplished. The inventor has been granted two patents, 1681004 and 1681005. S. Melton, Sturgis, Ky.

THERMOSTATIC CONTROL—For an electric circuit, with electro-magnetic means for opening and closing the circuit in combination with a thermostat, rendering the electro-magnetic means active under predetermined conditions. Patent 1681446. R. S. Tice., Monterey, Calif.

Of Interest to Farmers

POULTRY FEEDING AND WATERING DEVICE—Which provides an ample supply of food and water eliminating repeated feeding, and includes means for periodically flushing the water supply. Patent 1682614. H. V. Guertin, 32 Conklin Ave., Patchogue, L. I., N. Y.

Of General Interest

DRAINAGE DEVICE FOR WINDOW SCREENS—Whereby the rain or moisture forced through the screen will drain out to the exterior of the window frame. Patent 1681846. C. C. Engelbart, 721 Second Ave., Rochester, N. Y.

DEVICE FOR USE IN WRITING—An adjustable sliding tube and rings for correcting handwriting, and to insure that the pen or pencil is held in the correct position. Patent 1681842. D. Collen, c/o Canadian Pac. Express Co., Dryden, Ont., Canada.

ARTIFICIALLY-HEMSTITCHED FABRIC—Which simulates hemstitching by the use of black threads woven through the fabric, may be applied to towels, pillow cases, table cloths and other articles. Patent 1681827. F. Tausend, 114 Franklin St., New York, N. Y.

PROTECTIVE CAP FOR WOOD PILING—Which may be conveniently applied to any pile head for preventing rain water from collecting on the top and rotting the wood. Patent 1681857. J. Jacobson, 2311½ Ave. "C," Galveston, Texas.

OPTICAL DEVICE—Including a mirror which may be positioned relative to the eye, while using the thumb and finger of the hand to open the eye, and the other hand to remove foreign objects. Patent 1681874. A. F. Ouellet, c/o Tech. Lab. Corp., 693 Broadway, New York, N. Y.

SMOKERS' RECEPTACLE—A combined movable ash-tray, and dispensing container for cigars, cigarettes or the like, the tray constituting a supporting base for the container. Patent 1681852. W. I. Goscener, 483 Jersey Ave., Jersey City, N. J.

TOWEL DISPENSING AND STORAGE CABINET—Adapted to provide ample storage space for all the necessities of the toilet, such as paper towels, toilet paper, liquid soap, brushes, and disinfectants. Patent 1681840. A. E. Carlson, c/o Nevis Public School, Nevis, Minn.

POST—A device adapted to be fitted over the backs of chairs so that the tops are hidden and they present a solid row, such as a pew. Patent 1681020. J. F. Stimson, Lenoir, N. C.

GAS CONTROL—A valve which will automatically cut off the flow of gas in a house when the service line is under repair. The device may be manually reset. Patent 1681041. C. E. Kimbrough, Box 922, Haynesville, La.

ently, all that is necessary is to use an ordinary screw hook, inserting the screw portion through an opening in the lining and screwing it into the wooden casing beyond. In fact, that is the way refrigerator manufacturers used to do it before W. H. Whittier took out his two patents, one in 1910 and one in 1915.

There were difficulties with this practice, however, due to the rigidity of attachment between the lining and the case and the contraction and expansion to which the lining was subjected by temperature changes. The lining also had a tendency to warp in the process of baking the porcelain coating, and where the lining bulged inwardly at the opening left for the shell support, a greatly increased pressure was often necessary to affix it. This meant a tendency of the porcelain to chip.

Whittier's method, the patents for which were acquired by the Grand Rapids Refrigerator Company, avoided these difficulties. He attached the shelf supports to the lining before the lining was placed in the case. He rotated the bolt or threaded portion of the support, while that carrying the washer and in contact with the porcelain he held immovable during attachment. Thus he eliminated all stress and strain due both to attaching the shelf support and to temperature changes. There is no doubt that the method was a good one.

When the Grand Rapids Company came to sue Stevens and others for infringement, however, it ran into difficulties. The Federal District Court for Eastern Michigan declared the patent claims invalid for want of invention, and the Circuit Court of Appeals has upheld the decision. Judge Hickenlooper says:

"We are convinced that in the adoption of the specific shelf support of the claims in issue, the patentee exercised no more than a high degree of mechanical ability and power of selection. It may well be that the enumerated advantages of the use of this device in connection with enameled or porcelain coated metal had not theretofore been recognized, but the device itself is old, and as described in the patent, operates in a manner identical with the devices of the prior art. The use of the shelf support of the patent is only a new or enlarged use of an old device. Such discovery of new uses for or newly observed functions of a device well known in the mechanical or structural arts is not a patentable invention."

Trademarks in the Philippines

V. ALDANESE, Insular Collector of Customs for the Philippine Islands, has issued the following circular letter to all manufacturers, importers and others concerned:

"In connection with the registration of trademarks in all ports of entry in the Philippine Islands as prescribed by Customs Administrative Order Number 194, it is hereby announced that, in pursuance of an opinion of the Attorney-General rendered on July 25, 1928, United States trademarks registered in the United States Patent Office and recorded in this Bureau must also be registered in the Bureau of Commerce and Industry, Manila, Philippine Islands, in order to be entitled to the protection accorded by Act Number 2460 and to enable the owners thereof to sue for damages for any violation of their rights to such trademarks, under the provisions of Act Number 656, as amended by Act Number 3332."

OIL-STORAGE TANK—Adapted for containing oils of different specific gravities from crude oil to gasoline, and means for preventing, or minimizing, the losses by evaporation. Patent 1681098. M. O. Clark, c/o Standard Oil Co., Hong Kong, China.

SMOOTHING-IRON PROTECTOR—In the nature of a wire or light metal basket attached to one end of an ironing board for holding a hot iron. Patent 1681128. M. A. Morse, Jr., 5521 Woodlawn Place, New Orleans, La.

COMBINED LIQUID CONTAINER AND SPRAYER—Which affords facilities for holding a liquid, and also has operable means to cause the liquid to be discharged in an atomized state. Patent 1680983. G. B. Graf and F. E. Whitman, 132 No. McKinley St., Shawnee, Okla.

CHECKING TAG—Which will serve to prevent fraud at the time of reclaiming the article checked, and will also prevent the re-use of the tag. Patent 1679699. A. E. and A. G. Wright, Casaloma, Apts., Pine & Mason Sts., San Francisco, Cal.

DIVING APPARATUS—Having means for the general improvement of the device and the renewal of the air, as well as to proportionately increase the inside pressure as the depth increases. Patent 1681029. C. J. Cooke, 33 "B" St., N. W., Washington, D. C.

SINK CLEANER—Which may be used optionally for cleaning or scraping the walls of a sink, or as a shovel for removing matter from the sink. Patent 1681082. H. Bamberger, 1693 Linden St., Brooklyn, N. Y.

COMBINED SCISSORS AND SHOEHORN—Which accomplishes the dual functions, without impairing the manual operations of the scissors, or the insertion of the feet into shoes, as with a conventional shoe-horn. Patent 1681691. O. Altenbach, c/o Roosevelt & O'Connor, 120 B'way., New York, N. Y.

WALL SAFE—A fireproof safe, which may be installed between the wall lathing, will present a finished surface, and may be easily concealed by a picture or wall ornament. Patent 1681290. E. E. Glass, 2759 Effie St., Los Angeles, Calif.

CLOTHESPIN—Which will effectively clamp itself to a clothes line and to clothes suspended therefrom and prevents the clothes from shifting. Patent 1681461. W. R. Butner, Box 108, Yerington, Nevada.

GRINDSTONE AND METHOD OF MAKING SAME—By mixing abradant particles with cement, allowing the mixture to set, crushing the same into coarse aggregate, and adding a second plastic mixture to fill all the voids. Patent 1682649. J. L. Weller, 294 Bay St., So. Hamilton, Ont., Canada.

GLAZING SYSTEM—More particularly intended for use in that class of buildings known as the steel skeleton type, whereby a more practical, and more weather-tight method is provided. Patent 1682291. L. Lane, P.O. Box 1066, Habana, Cuba.

TOASTER AND BROILER—Having rockable bread or meat-holding devices, and means to throw out the bread or meat, after a predetermined time for which the device is set. Patent 1682683. A. C. Parodi, 44½ Cottage St., Jersey City Heights, N. J.

PHOTOGRAPHIC FILM OR PLATE PACK—With means for simplifying and cheapening the arrangement by reducing the size of the backing sheets to substantially that of the film or plate. Patent 1682628. M. and J. Romanowicz, c/o Paget, Monller & Hardy, Reimergasse, 6 Vienna 1, Austria.

SADIRON RECEPTACLE—Adapted to be built in the wall of a room to provide a concealed housing for a sad iron when not in use, and even when heated, yet readily accessible. Patent

1681291. E. E. Glass, 2759 Effie St., Los Angeles, Calif.

Hardware and Tools

DOOR-HOLDING TOOL—For holding a door in both closed or open positions, with various positions between open and closed, including holding a door while mortising for a lock. Patent 1681834. A. A. Arends, R.F.D. Box 303B, Menlo Park, Calif.

WATCHMAKERS GAUGE—For ascertaining the dimensions and distance between an end and the shoulder of a balance staff in repairing watches where the staff has been broken. Patent 1681-121. R. Larsen, c/o Arnold Green, 2500 Webb Ave., Bronx, N. Y.

TOOL JOINT LOCK—By which a drilling tool joint is automatically locked in coupled position against accidental uncoupling, yet capable of being unlocked when desired. Patent 1681699. J. C. Coates, 1003 East Virginia Terrace, Santa Paula, Calif.

CLAMP—Designed to clamp either a few or a great number of sheets, so as to hold them firmly in register while being cut or otherwise treated. Patent 1682604. H. G. Disbrow, c/o New York Trust Co., 100 Broadway, New York, N. Y.

Heating and Lighting

HEAT-CONDUCTIVITY APPARATUS—Which affords facilities for ascertaining the relative heat conductivity of any substance, the heat conductivity of common silver being taken as a standard. Patent 1680638. F. M. Rowan, Collins, Ga.

FLASH BOILER—Which is capable of producing in an economical and efficient manner a high steam pressure from a relatively small amount of water. Patent 1680608. A. G. Garbutt, Jessup, Ga.

OIL BURNER—Embodying a rotating spreader for the oil which minimizes the formation of carbon, and a motor for actuating a fan which supplies air to the burner. Patent 1682615. H. H. Holmes and A. F. Espersen, 520 Batavia Bank Bldg., La Crosse, Wis.

Machines and Mechanical Devices

POCKET SPACE STAMPING MACHINE—For holding in place a plurality of shirt fronts, together with means for successively stamping the fronts to indicate where the pockets are to be placed. Patent 1681882. J. F. Silverman, 5042 38th St., Brooklyn, N. Y.

MACHINE FOR CASTING STEREOTYPE PLATES HAVING A MOLD ADOPTED TO BE PRESSED AGAINST THE OUTLET OPENING OF THE POT—Which automatically controlls the flow of metal from the pot to the casting pot without the parts coming out of engagement with each other. Patent 1681872. E. Muller, c/o Winkler Fallert & Co., Bern, Switzerland.

DISH WASHING STERILIZING AND DRYING MACHINE—Including a revolving trough with apertures for the dishes, and means for projecting jets of washing and rinsing water, withdrawing the water, and producing an air current for drying. Patent 1681839. J. L. Breton, c/o C. Bletry, 2 Boulevard de Strasbourg, Paris, France.

COTTON-GIN-BREAST-ACTUATING DEVICE—A mechanism automatically latched to sustain the breast against falling, upon being actuated to elevated position, and thereby preventing injury to workmen. Patent 1681837. T. M. Bruce, c/o Guthrie Cotton Oil Co., Guthrie, Okla.

KEY-ALIGNER—For accurately aligning concrete sheet pilings as they are driven into the ground, the key co-operating with grooves in the abutting edges of the pilings. Patent 1681858. J. Jacobson, 2311½ Ave. "C," Galveston, Texas.

PRINTING PRESS UNIT—Comprising two half-units, each having cylinders thereon, and means for driving the cylinders of each half independently, and in either the same, or opposed directions. Patent 1680018. W. H. Granger, c/o Duplex Printing Press Co., 323 De Young Bldg., San Francisco, Calif.

APPARATUS FOR DYEING YARN—Especially designed for permitting the dye or other liquid to be forced by pressure through the yarn, when it is wound on a perforated bobbin. Patent 1681088. L. Bounous, Valdese, N. C.

CLOTH-ROLLING MACHINE—Which rolls the cloth smoothly, and positively precludes the formation of wrinkles, where the cloth is subsequently to be sliced into narrow strips. Patent 1680979. P. Gardner, c/o H. M. Bunker Co., 56 Worth St., New York, N. Y.

BELT SCRAPER FOR TRACTORS—For cleaning the central portion of the treads and for dislodging the material adhering to the lugs, particularly adapted for use on snow covered land. Patent 1682623. J. Mosca, Box 83, Rouse, Colo.

WIND-CONTROLLED STEERING GEAR—In the form of a wind vane, by which the direction of the prevailing wind will control a sailing vessel, and keep it true to its course. Patent 1681415. H. A. Lee, c/o P. W. D. Sewa, Fiji Islands.

SAFETY HOOK—Having a latch which positively closes by gravity and prevents all danger of the hook catching in a derrick or other object, in hoisting machinery. Patent 1682617. W. G. and K. R. Jensen, c/o Jensen Mfg. Co., Nowata, Okla.

DISPENSING DEVICE—Which insures the sanitary discharge of a predetermined number of toothpicks, and prevents the handling of others than the ones taken for personal use. Patent 1682629. L. Rossi, 20 La Salle St., New York, N. Y.

Medical Devices

OIL SPRAY—Including a barrel, and a plunger connected exteriorly of the barrel, for applying the proper amount of oil for the treatment of any particular case. Patent 1680645. C. E. Sims, c/o Farmers and Bankers Life Ins. Co., Sweet Waters, Tex.

POCKET SPUTUM CUP—Constructed from a single sheet of material, with a closure flap formed to positively seal the cup against the escapement of the contents. Patent 1680151. J. Kauffman, 531 W. 179th St., New York, N. Y.

Plumbing and Fittings

CLEANABLE TRAP FOR SINKS AND THE LIKE—Which provides a straight pipe with readily accessible cleaning chambers, yet preventing all possibility of sewer gas backing up, and eliminates the gooseneck. Patent 1681117. H. A. W. Howcott, 720 Union St., New Orleans, La.

Prime Movers and Their Accessories

OIL PURIFIER—A device in which portions of the oil are heated to render them easily strained and to free them from gasoline vapors before returning to the crank case. Patent 1680716. D. F. Zook, Hotel Monnett, Evanston, Ill.

Railways and Their Accessories

RAILROAD TIE—Constructed from a combination of wood and steel, having the advantages of a wooden tie, but requiring only a minimum amount of wood. Patent 1681115. E. E. Hendrickson and G. C. Dixon, 520 7th Ave., Watervliet, N. Y.

AUTOMATIC STOPPING SYSTEM FOR RAILROAD CARS—Characterized by the braking shoe being provided with two guiding devices whereof one is fixed and the other movable, while remaining parallel with the track. Patent 1681106. J. Farenc, c/o Office Pickard, 97 Rue St. Lazare, Paris, France.

RAIL-FASTENING DEVICE—Designed to be interposed between the spike and rail edge, and provides inclined forming wedges co-operating with the opposite edges of the spike to prevent creeping of the rail. Patent 1681049. H. H. Renfroe, 412 Hammond St., Rocky Mount, N. C.

Pertaining to Recreation

STEAMBOAT AND LIKE TOY CONSTRUCTION AND PRINTED BLANK THEREFOR—Which will provide a toy by simply cutting out a sheet of material along printed lines, and bending along the lines to complete the object. Patent 1681878. F. E. Prince, 27 McKinley St., Bangor, Maine.

GAME—Wherein balls can be projected upwardly into a basket contained within a cage carrying out the idea of a basket ball game. Patent 1681682. L. S. McVey, Rulo, Neb.

GAME APPARATUS—Embodying a game board with targets corresponding to the bases on a baseball field, the targets being releasable only upon first striking a master target with a suitable projectile. Patent 1681693. F. W. Becker, 132 Wadsworth, Ocean Park, Calif.

TRIANGLE PAD—In the form of a table protector and cleaning device for balls, for use in racking the balls on a pocket billard table. Patent 1682616. F. C. Irving, 632 73rd St., Brooklyn, N. Y.

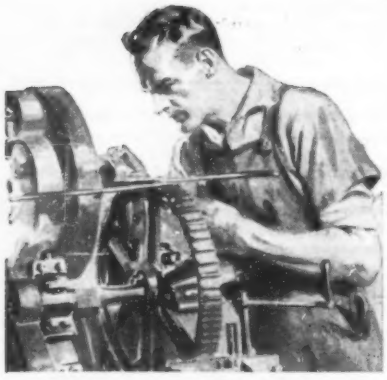
Pertaining to Vehicles

ILLUMINATING LAMP FOR AUTOS—An extensible "trouble lamp" the various parts of which may be readily attached to the dash board and connected with the automobile electric system. Patent 1680508. V. S. Downing, West Jackson, P.O., Jackson, Miss.

INFLATION DEVICE—For automobile tires, in which the main air supply is connected with a gauge, enabling the user to read the pressure of the tube under inflation. Patent 1682625. E. J. Olsen, 7th & Margaret Sts., North St. Paul, Minn.

MATCH BOX HOLDER—Which is capable of being readily applied to the steering wheel of an automobile so as to be within convenient reach of the operator. Patent 1681710. R. M. Ostrander, 1276 No. Wilton Place, Los Angeles, Calif.

TRACTOR ATTACHMENT—For use in connection with trucks or other vehicles stuck in the mud or in a hole, and will function to propel onto solid ground. Patent 1682717. A. Corona, c/o N. Hirsch, 1819 Broadway, New York, N. Y.



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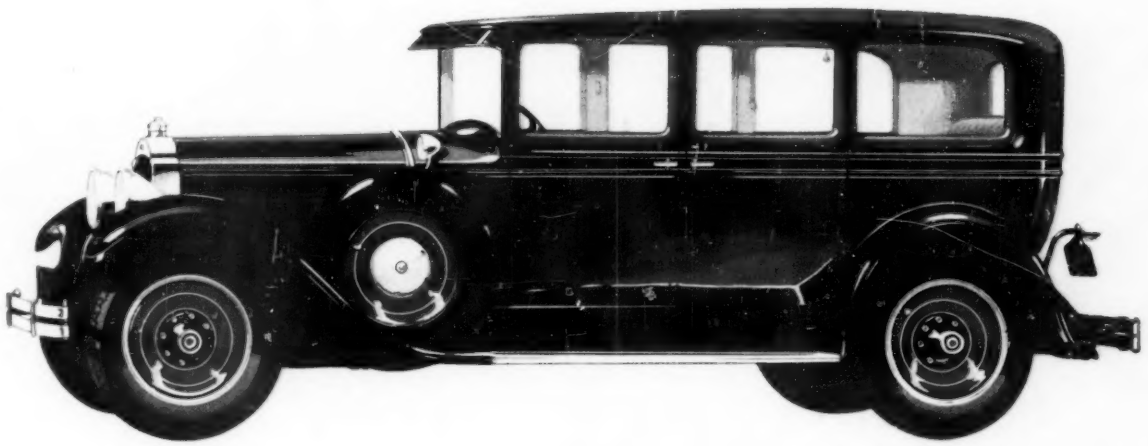

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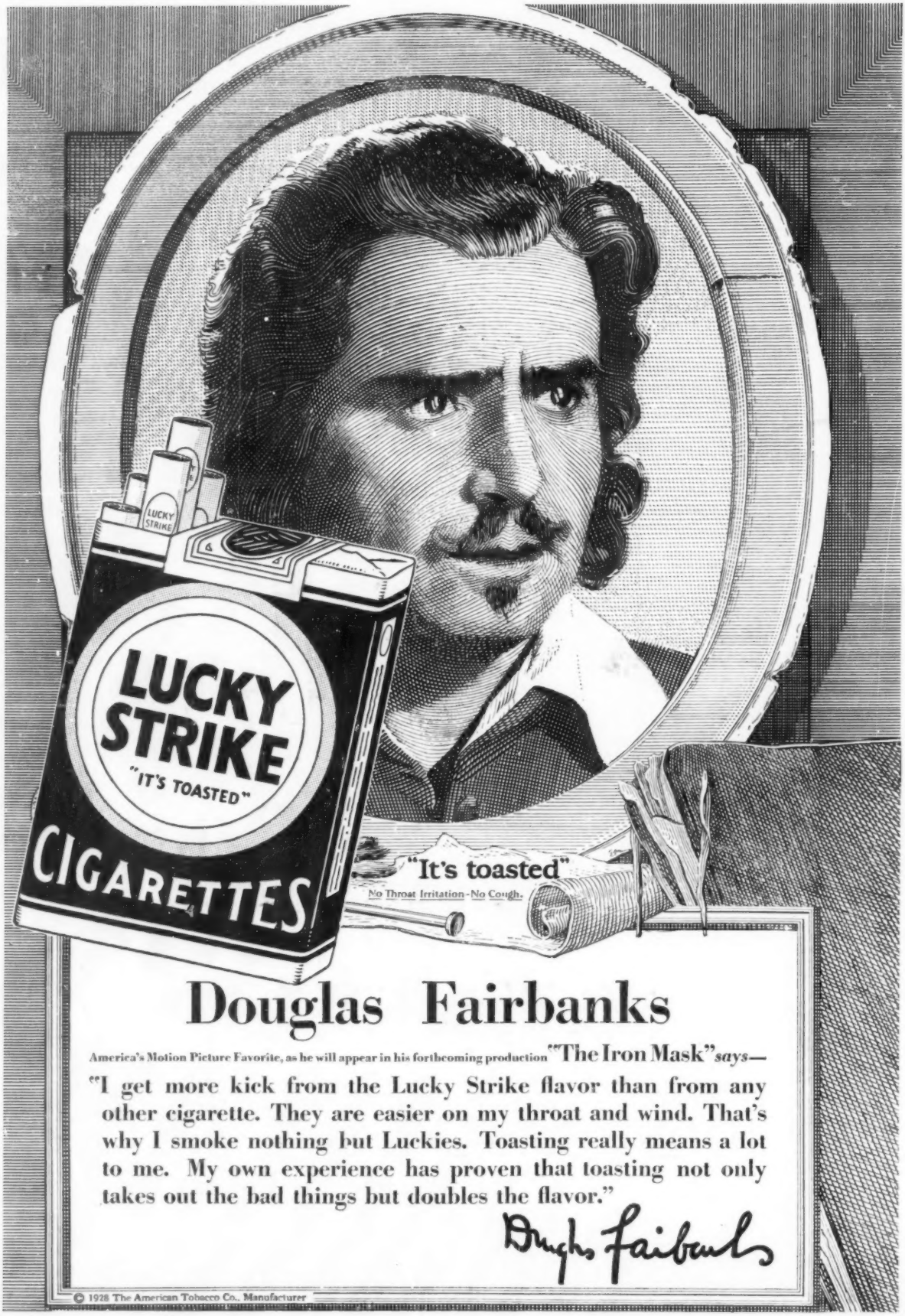

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